



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Office of Response and Restoration
Silver Spring, Maryland 20910

CRUISE REPORT¹

VESSEL: *Hi'ialakai*, Cruise HI-06-12 (Fig. 1)

CRUISE PERIOD: 10-29 October 2006

AREA OF OPERATION: Middle Brooks Bank, W. Brooks Bank, St. Rogatien Bank, W. Nihoa Bank, Northwestern Hawaiian Islands (NWHI)

TYPE OF OPERATION: Personnel from the Coral Reef Ecosystem Division (CRED) of NOAA's Pacific Islands Fisheries Science Center (PIFSC) and the Hawaii Mapping Research Group (HMRG), University of Hawaii, conducted multibeam mapping and BotCam operations at Middle Brooks Bank, West Brooks Bank, St. Rogatien Bank, and W. Nihoa Bank, NWHI.

ITINERARY:

Tues, 10 Oct. (283) Start of cruise. Embarked Joyce Miller (Chief Scientist, CRED), Scott Ferguson (CRED), Margo Edwards (UH/HMRG), Susan Vogt (CRED), Jeremy Jones (CRED), Jonathan Weiss (CRED), Daniel Merritt (CRED), Frances Lichowski (CRED), Kevin Lino (CRED), Frank Mancini (CRED), Jason Helyer (CRED). Departed Honolulu at 1600 Local Time (L). Multibeam training was conducted in afternoon prior to sailing.

Wed, 11 Oct. (284) Transit day. Multibeam training conducted in morning and afternoon. Fire and abandon ship drills were done in morning. Conducted conductivity-temperature-depth (CTD) cast at permanent CTD site south of Nihoa Island. Continued transit to Brooks Bank area.

¹ PIFSC Cruise Report CR-07-003
Issued 21 February 2007



- Thurs, 12 Oct. (285) Transit day. Multibeam training continued. Introduction to bottomfish digital stereo-camera bait system (BotCam) operations presented in afternoon. Conducted CTDs at permanent CTD sites south of Necker Island and French Frigate Shoals.
- Fri, 13 Oct. (286) Arrived at Middle Brooks Bank. Conducted CTD cast. Began shipboard multibeam surveys. Launched R/V *AHI*. Deployed one BotCam array on southwest side of Middle Brooks Bank. Launched R/V *HI-1*. Continued shipboard survey. Retrieved R/V *AHI* in early afternoon because of computer problems – no multibeam survey done. Retrieved R/V *HI-1* at ~1400 L. In two BotCam deployments, the bait did not deploy; video was successful documenting unbaited BotCam operations. Continued with shipboard CTD and multibeam survey operations.
- Sat, 14 Oct. (287) Continued with shipboard CTD and multibeam survey operations at Middle Brooks Bank. Launched R/V *AHI*. Deployed two BotCam arrays from ship on southwest side of Middle Brooks Bank. Launched and recovered R/V *HI-1*. Recovered R/V *AHI* in afternoon after successful mapping operations. A total of four BotCam operations were successfully completed. Continued with shipboard CTD and multibeam survey operations at Middle Brooks Bank.
- Sun, 15 Oct. (288) Continued with shipboard CTD and multibeam survey operations at Middle Brooks Bank. Deployed two BotCam arrays from ship on southeast side of Middle Brooks Bank. Launched *HI-1*. Launched and recovered R/V *AHI* for troubleshooting on vessel's air conditioner. Recovered *HI-1* in afternoon after successful BotCam operations. A total of four BotCam operations were successfully completed. Continued with shipboard CTD and multibeam survey operations at Middle Brooks Bank.
- Mon, 16 Oct. (289) Continued with shipboard CTD and multibeam survey operations at Middle Brooks Bank. Deployed two BotCam arrays from ship on southeast side of Middle Brooks Bank. Launched *HI-1*. Launched and recovered R/V *AHI* for troubleshooting on vessel's generator. Recovered *HI-1* in afternoon after successful BotCam operations. A total of four BotCam operations were successfully completed. Continued with shipboard CTD and multibeam survey operations, moving to West Brooks Bank.
- Tues, 17 Oct. (290) Continued with shipboard CTD and multibeam survey operations at West Brooks Bank and between West and Middle Brooks Banks. No small boat deployment because of weather conditions.

- Wed, 18 Oct. (291) Continued with shipboard CTD and multibeam survey operations at West Brooks Banks. Transited to St. Rogatien for BotCam and *AHI* operations. Launched R/V *AHI*. Deployed two BotCams from ship on southwestern edge of St. Rogatien. Launched *HII* for BotCam operations. Conducted CTD casts on southwest edge of St. Rogatien. Retrieved R/V *AHI* because of generator and I/O drive problems. Conducted multibeam survey on St. Rogatien. Retrieved *HII*. A total of six successful BotCam deployments were made on the southwest side of St. Rogatien Bank. Transited back to W. Brooks Bank and continued CTDs and survey.
- Thurs, 19 Oct. (292) Continued with shipboard CTD and multibeam survey operations at West Brooks Bank. No small boat deployment.
- Fri., 20 Oct. (293) Continued with shipboard CTD and multibeam survey operations at West Brooks Bank. No small boat deployment. Sea surface temperature pump failed because of rough sea conditions and intake of air.
- Sat., 21 Oct. (294) Continued with shipboard multibeam survey operations at West Brooks Bank. Did gap fills at Middle Brooks Bank under marginal survey conditions. No small boat or CTD deployment. At 1600, begin transit to Nihoa with 15–20 ft. seas.
- Sun., 22 Oct. (295) Transited to Nihoa, “tacking” to maintain reasonable ride under rough sea and wind conditions.
- Mon., 23 Oct. (295) Continued transit to Nihoa. Arrived at 1830 (50 hr/250 nmi transit). Deployed shipboard CTD cast. Started survey on W. Nihoa Bank.
- Tues., 24 Oct. (296) Continued CTDs and shipboard multibeam survey on W. Nihoa Bank.
- Wed., 25 Oct. (297) Continued CTDs and shipboard multibeam survey on W. Nihoa Bank. At 1200, deployed two BotCams and launched *HI-1*. Total of four successful BotCam deployments. Retrieved *HI-1* and continued survey.
- Thurs., 26 Oct. (298) Continued CTDs and shipboard multibeam survey on W. Nihoa Bank. At 0800, deployed two BotCams and launched *HI-1*. Total of six BotCam deployments; on two deployments the bait did not release. Recovered *HI-1* and continued survey.
- Fri., 27 Oct. (299) Continued CTDs and shipboard multibeam survey on W. Nihoa Bank. At 0830, deployed two BotCams and launched *HI-1*. Total

of six successful BotCam deployments. Recovered *HI-1* and continued survey.

Sat., 28 Oct. (300) At 0000, began transit from W. Nihoa to Honolulu.

Sun., 29 Oct. (301) At 0900, arrived at Aloha Tower, Honolulu.

CRUISE STATISTICS:

Table 1: Cruise statistics for Brooks, St. Rogatien, and W. Nihoa Bank

Activity	Permanent Stations	Brooks Banks	St. Rogatien Bank	W. Nihoa Bank	Totals
Multibeam (sq. km.)		665	50		
AHI Deployments		5	0	0	5
BotCam Deployments		14	6	16	36
CTDs	3	30	1	8	41

MISSIONS AND RESULTS:

- A. Conduct benthic habitat mapping of the reefs and submerged banks surrounding Brooks and St. Rogatien Banks and Nihoa Island using ship-based and launch-based multibeam echosounders.
1. Mapping from the *Hi'ialakai* resulted in the collection of high resolution multibeam bathymetry and backscatter imagery in the proposed survey areas. The survey methods used are described in Appendix A.1.
 2. Shipboard multibeam surveys on Middle Brooks Bank and West Brooks Bank were completed from depths of 32 to greater than 1000 m. Bathymetric data were completely processed and 5- and 20-m grids were prepared. Preliminary maps are included in Appendix B.
 3. Shipboard multibeam surveys on West Nihoa Bank were done from depths of 30 m to greater than 500 m and approximately 50% of the W. Nihoa banktop was surveyed. Bathymetric data were completely processed and 5- and 20-m grids were prepared. Preliminary maps are included in Appendix C.
 4. The R/V *AHI* was deployed on five days at Middle and West Brooks Banks. Only one day of multibeam survey was completed. Rough seas and mechanical difficulties prohibited further deployments of the R/V *AHI*.
 5. Significant progress was made on preparation of updates to the on-going NWHI bathymetric synthesis for all data NWHI collected in 2006. 20-m grids were prepared for all areas surveyed in 2006 including areas around

Kure, Midway, Pearl and Hermes, Brooks, and Nihoa. Updated grids will be available in early 2007 at www.soest.hawaii.edu/pibhmc.

6. Significant progress was also made in processing multibeam backscatter data collected in the NWHI, the MHI, and in other Pacific areas during the cruise.
- B. Deploy BotCam to assess the abundance of bottomfish within the NWHI coral reef ecosystems.
1. BotCam survey methods are described in Appendix A.3.
 2. The BotCam was deployed fourteen times on Middle and West Brooks Banks. Of two of the fourteen deployments, the bait did not release properly, but video was collected. On St. Rogatien Bank, the BotCam was deployed 6 times. Preliminary analysis of the video data was done and results from these BotCam deployments are discussed in Appendix B.3.
 3. The BotCam was deployed sixteen times on West Nihoa Bank. On two of the sixteen deployments, the bait did not release properly, but video was collected. Results from these BotCam operations are discussed in Appendix C.3.
- C. Conduct CTDs as necessary to support multibeam mapping and regular monitoring at a set of predetermined CTD stations in the NWHI.
1. Three permanent CTD stations were done at Nihoa, Necker, and French Frigate Shoals with casts to 500 m.
 2. A total of 39 CTD casts were done from the ship and the R/V AHI in support of multibeam data collection and BotCam operations.

SCIENTIFIC PERSONNEL:

Joyce Miller, Chief Scientist, Joint Institute for Marine and Atmospheric Research
(JIMAR), University of Hawaii (UH), Coral Reef Ecosystem Division (CRED)
Jonathan Weiss, Mapping Lead, JIMAR, UH, CRED
Scott Ferguson, Logistics Manager, Pacific Islands Fisheries Science Center
(PIFSC), National Marine Fisheries Service (NMFS), CRED
Jeremey Jones, *AHI* Lead, JIMAR, UH, CRED
Frances Lichowski, *AHI* Surveyor, JIMAR, UH
Danny Merritt, BotCam Lead, JIMAR, UH, CRED
Susan Vogt, Multibeam Watchstander, JIMAR, UH, CRED
Kevin Lino, Trainee, JIMAR, UH, CRED
Jason Helyer, Trainee, JIMAR, UH, CRED
Frank Mancini, Trainee, JIMAR, UH, CRED
Margo Edwards, Training Coordinator, JIMAR, UH, CRED

DATA COLLECTED:

Digital multibeam bathymetric and backscatter data in Generic Sensor Format (GSF).
Digital video data from BotCam deployments.
Conductivity, temperature and depth data including turbidity from small vessel casts
Conductivity, temperature and depth data including dissolved oxygen and chlorophyll
concentration from shipboard casts.
Acoustic Doppler current profile (ADCP) data

(/s/Joyce Miller)

Submitted by: _____
Joyce E. Miller
Chief Scientist

(/s/David Kennedy)

Approved by: _____
David Kennedy
Program Manager
Coral Reef Conservation Program

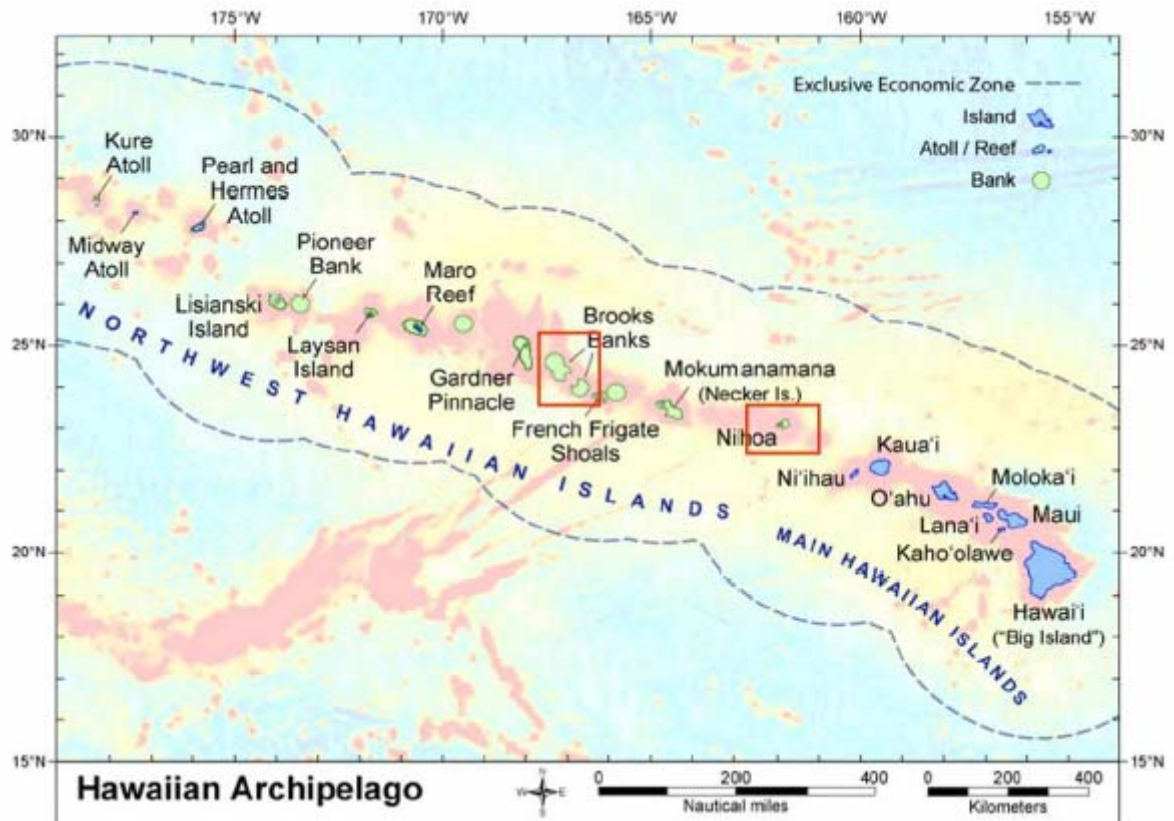


Figure 1. Areas surveyed on cruise HI0612.

Appendix A: Methods

A.1 Benthic Habitat Mapping Methods

(Joyce Miller, Jonathan Weiss, Scott Ferguson, Margo Edwards, Susan Vogt, Jeremy Jones, Frances Lichowski, LTJG Olivia Hauser, and ST Lillian Stuart)

System Descriptions

Multibeam mapping capability for cruise HI0612 included two shipboard multibeam echosounders (Kongsberg EM300 and EM3002D) and the Reson 8101ER multibeam aboard the 8-m launch R/V *Acoustic Habitat Investigator (AHI)*. Table A1-1 provides an overview of the three multibeam sonars and their capabilities.

Table A1-1. Sonar System Capabilities.

Sonar	Vessel	Freq. (kHz)	Depth Range (m)	Beam Size (deg)	Number of Beams
EM300	<i>Hi'ialakai</i>	30	30-3000	1 ½ x 1 ½	135
EM3002D	<i>Hi'ialakai</i>	300	2-150	1 x 1	320-508
Reson 8101ER	<i>AHI</i>	240	2-250	1 ½ x 1 ½	101

In addition to the multibeam sonars, each vessel is equipped with an Applanix Position Orientation Sensor for Marine Vessels (POS/MV) vertical reference system, which provides timing, position, velocity pitch, roll, heave, and heading information for correction of motion in the multibeam data. Three different conductivity-temperature-depth (CTD) sensors were used to provide sound velocity profiles (SVPs) that are critical for proper correction of sound velocity errors associated with multibeam data.

All sensors on both vessels were interfaced to the SAIC ISS-2000 data acquisition and survey control system, which includes survey planning, data acquisition, and data processing capabilities.

Methods for acquisition and post processing

Prior to the cruise, data were assembled to provide a baseline for acquisition of multibeam data. These data included (1) grids of multibeam bathymetry data from previous cruises to Brooks and St. Rogatien Banks and to Nihoa; (2) IKONOS imagery; (3) predicted tides for stations 1611400 Nawiliwili, 1619910 Midway, and 1617433 Kawaihae; (4) tide zones corrections (provided by NOAA Center for Operational Oceanographic Products and Services); and (5) preliminary survey plans. These data were integrated into the ISS-2000 software either before or during the first part of the cruise. In addition, existing grids, and tow location data from 2001 to 2006 cruises were assembled and integrated into the Arc 9 Geographic Information System (GIS).

The ISS-2000 survey system is used on both the ship and the launch, enabling seamless sharing of data between the two vessels. The Generic Sensor Format (GSF), which is implemented in the ISS-2000 system, allows logging of multibeam data from a variety of multibeam sonars into a single, standardized format; the GSF also provides integrated metadata within the real-time multibeam files. In addition, the ISS-2000 creates digital message logs that allow full traceability of software and real-time events.

During system configuration, all vessel offsets are entered into either the POS/MV, the sonar, or into the ISS-2000. In addition, predicted tides are calculated for all tide zones to be surveyed and then recorded into the data in real time. Survey plans can be loaded into the real-time system on both vessels; coverage grids that are generated in real time during data acquisition can be viewed during planning, acquisition, and processing phases.

SVPs are taken at the beginning of each 12-hour period of surveying on the ship and each 8-hour day of surveying on the *AHI*. Standardized survey procedures, including a 2-minute warm up on deck and a 2-minute surface equilibration, are used on every cast. After the sound velocity cast is done, the data are downloaded with VelocWin software on the ship and with the SeaBird software on the launch. Sound velocity profiles are loaded using the ISS-2000 download utility; the downloaded profiles are sent to the two Kongsberg sonars on the ship and to the Reson sonar on the *AHI*, and the sound velocity information is logged as a part of the GSF. A real-time probe is used on the ship to monitor the surface sound velocity (SSV); if a difference between the SSV and the SVP at the surface is greater than 3 m/sec, an alarm is generated. The sonar on the *AHI* is less susceptible to SSV errors, and the daily casts are generally sufficient to correct for sound velocity. In all cases, the data are carefully monitored for sound velocity artifacts using the real-time displays.

During real-time operations, the ISS-2000 operator starts the ISS-2000 software, making sure to load the appropriate system configuration file. The System Control and Message windows are loaded at that time. The operator creates a dataset for the entire cruise that is named with the corresponding cruise delineator; *Hi'ialakai* and *AHI* data were logged into separate datasets (HI0612 and AHI0612) for file management purposes. After the dataset is created and all configurations are checked, "Start Survey" is selected and the Navigation Manager, Multibeam Manager, and Helm Display windows are opened. Text icons for all programs appear in the System Control window; the icons can be colored white, yellow, red, or green. White means that the program is selected but not activated; yellow means the program is activated but not logging; red means that there is a problem with the program; and green means that the program is operating and data are being logged. Files are automatically created for all multibeam sensors, for navigation inputs, for the POS/MV vertical reference, and for the messages generated by the system. Predicted tide files that can be used throughout 2006 were prepared before the cruise and were applied to the multibeam data in real time.

After the ISS-2000 Navigation Manager is started, a survey plan is chosen and one or more surveys are selected for execution. Tide zones, existing coverage grids, and

navigational charts can be loaded into the display, if desired. The navigated ship icon appears on the screen. Survey lines are then selected from the survey file or made in real time and loaded into a Survey Schedule; lines can be selected in any order and their azimuth can be reversed; these lines appear on the screen when loaded into the schedule. When survey lines are being run in Survey Mode, the multibeam data is almost always logged (if logging is activated), but may be flagged as either “online” or “off-line.” During transits, survey can be done in the “Underway Mode,” but a flag must be set to not flag the off-line data during transits. If a coverage grid is loaded using the Coverage Monitor program and enabled for real-time logging, multibeam data are added to the coverage grid in real-time.

The Helm Display is also activated when the survey is started. This Helm Display appears both on the survey lab screens and on a screen on the bridge, and screen display parameters can be manipulated at either location. The same coverage grids, navigation charts, and survey lines selected in the Navigation Manager interface appear on the Helm Display as well; however, the display of these grids, charts, and lines can be turned on and off in the Helm Display independently of the Navigation Manager. The Helm Display can also be changed to different scales and color schemes than what is displayed on the Navigation Manager. The ISS-2000 feature, display of the coverage grids on the Helm Manager, enabled the bridge to steer lines in underway mode based upon existing coverage rather than always needing to create a formal survey line for the bridge to follow.

The Multibeam Manager is used to monitor the status of data files, to view and apply SVPs, and to view the multibeam bathymetry and backscatter data in real time. Many problems with the data can be detected immediately using feedback from these real-time displays. The Kongsberg SIS interfaces for the EM300 and the EM3002 are mounted above the two ISS-2000 screens, and other multibeam displays that provide different views of the data are available through SIS. Backscatter displays for all systems showed distinct and intriguing bottom types, but the ultimate quality of the data from the different sonars cannot be evaluated until data processing is complete.

During HI0612 aboard ship, multibeam data were collected day and night. The EM300 was used for depths between 100 m and 1500 m and the EM3002 was used for depths between 15 m and 200 m.

The *AHI* was deployed on 5 days at Middle Brooks Bank and data collection was concentrated in depths between 10 m and 100 m. The rough seas and a number of mechanical problems with the *AHI* prevented the launch from being effectively used during this cruise.

HI0612 data were logged to two disks simultaneously in real time. The ISS-2000 AutoArchive program, which copies the data to a third permanent archive disk was run as needed during post processing. The AHI0612 dataset was logged on the real-time computer in the launch, and a second copy of the data was manually made on a portable disk; the disk was then moved to the ship and connected to the shipboard computers, and

the data were read to the permanent archive disk. A final copy of all data was made to the PIBHMC network disks, and data processing was done on only this copy of the data. The SABER data processing package, which provides full multibeam processing capability, was primarily used to manually edit the multibeam data in GSF, to plot tracklines, to update SVPs and tide data when necessary, and to create gridded data sets using the Pure File Magic (PFM) format that enables editing the integrated data set within the grid as well as reading any edits made in the grid back to the GSF multibeam files. Tape backups of all processed data were made one to two times per bank visited. The gridded data sets were converted to ASCII files for conversion to Arc raster grids. Map products were made as grids were created and added to the GIS product archive.

Backscatter data are logged as part of the GSF multibeam file and will be processed at PIBHMC after return to Honolulu.

A.2 Oceanography and Water Quality Methods

(Danny Merritt, Kevin Lino, Jason Helyer, and Frank Mancini)

Monitoring and assessment methodology

During HI0612, oceanographic observations included conductivity, temperature and depth (CTD) casts performed at permanent CTD stations, in conjunction with multibeam mapping efforts, or as a cast of opportunity during BotCam operations. Further data collection included shipboard acoustic Doppler current meter (ADCP) and scientific computer system (SCS) measurements.

Sampling was intended to provide a focused analysis of vertical profiles concerning water properties to provide indications for water mass movement, local seawater chemistry changes, and chlorophyll concentration. These activities included:

1. Small vessel CTD casts: Conductivity, temperature and depth (CTD) casts were performed to a depth of approximately 125 meters from a 10-meter launch using an SBE 19+. Deployments were done near BotCam drop sites. Additional small vessel CTD casts using an SBE 19 were also performed by the multibeam launch *AHI* as part of their mapping requirements.
2. Shipboard CTD casts: Conductivity, temperature and depth (CTD) casts, , were performed to a maximum depth of 500 meters from the *Hi'ialakai* using an SBE911. These casts were performed at permanent CTD sites along the Northwestern Hawaiian Islands Archipelago during transit near these sites. Shallower 200- to 500-meter casts were performed two to three times per day as needed for multibeam mapping applications.
3. Acoustic Doppler Current Profiler (ADCP) data provide information on oceanographic current structure from the surface to 600 m. The ADCP was run constantly.
4. The Scientific Computer System (SCS) data was collected as part of the *Hi'ialakai*'s standard operating procedure. SCS data includes time, latitude, longitude, speed over ground, course over ground, true wind speed, true wind direction, sea-surface temperature, sea-surface salinity, air temperature, relative humidity, barometric pressure, and water depth.

A.3 BotCam Methods

(Danny Merritt, Kevin Lino, Jason Helyer, and Frank Mancini)

The bottomfish digital stereo-camera bait (BotCam) system contains two stereo-video cameras housed within an aluminum frame. Attached to the frame is a removable bait arm. This positively buoyant frame is made negatively buoyant with sacrificial concrete anchors which are attached with an acoustic release. The cameras are arranged on the frame to float between 1.5 to 3 meters off the bottom, allowing the system to operate in high rugosity and steep terrain. The stereo-video configuration allows for the sizing and ranging of both fish and benthic features. The BotCam system includes programmable control functions that allow for the activation of imaging systems, bait release, image scaling indicators, and acoustic recovery. A Seabird SBE39 temperature and pressure recorder is also attached to each BotCam.

The BotCam is deployed to target bottomfish essential fish habitat between 100 and 300 meters on steep slopes or deep pinnacles. The deployment sites are established prior to deployment using multibeam data and are located by Global Positioning Systems. Two BotCam units are deployed repetitively over a survey area up to three times each operational day for a maximum of six drops per day. The stations sit dormant on the seafloor and are activated approximately 20 minutes after deployment. Prior to deployment, a bait container is filled with a mixture of ground squid and mackerel and then sealed. The unit is programmed to turn on 20 minutes after activation and is set to record for 1 hour. After 10 minutes of recording, a signal is sent to the bait release system to release the bait. Once the bait release signal is sent, there is a 2- to 8-minute delay for the actual bait release to occur. Once the recording is complete, an acoustic signal is sent from the retrieval boat to the BotCam's acoustic release, freeing the system from the concrete blocks and allowing the BotCam to float to the surface. A small vessel can then retrieve the surface line and reel in the BotCam. The BotCam can then be readied for redeployment or returned to the ship for data recovery.

Appendix B: Brooks Banks and St. Rogatien Banks

Multibeam, CTD, and BotCam operations were conducted at Middle and West Brooks Banks and St. Rogatien Bank from October 13 to October 21, 2006.

B.1. Benthic Habitat Mapping

Figure B1.1 shows multibeam data that had been collected around Brooks and St. Rogatien Banks in 2002 and 2005. These data are re-collated annually and made available at www.soest.hawaii.edu/pibhmc. This map was used as a baseline for survey planning for cruise HI0612.

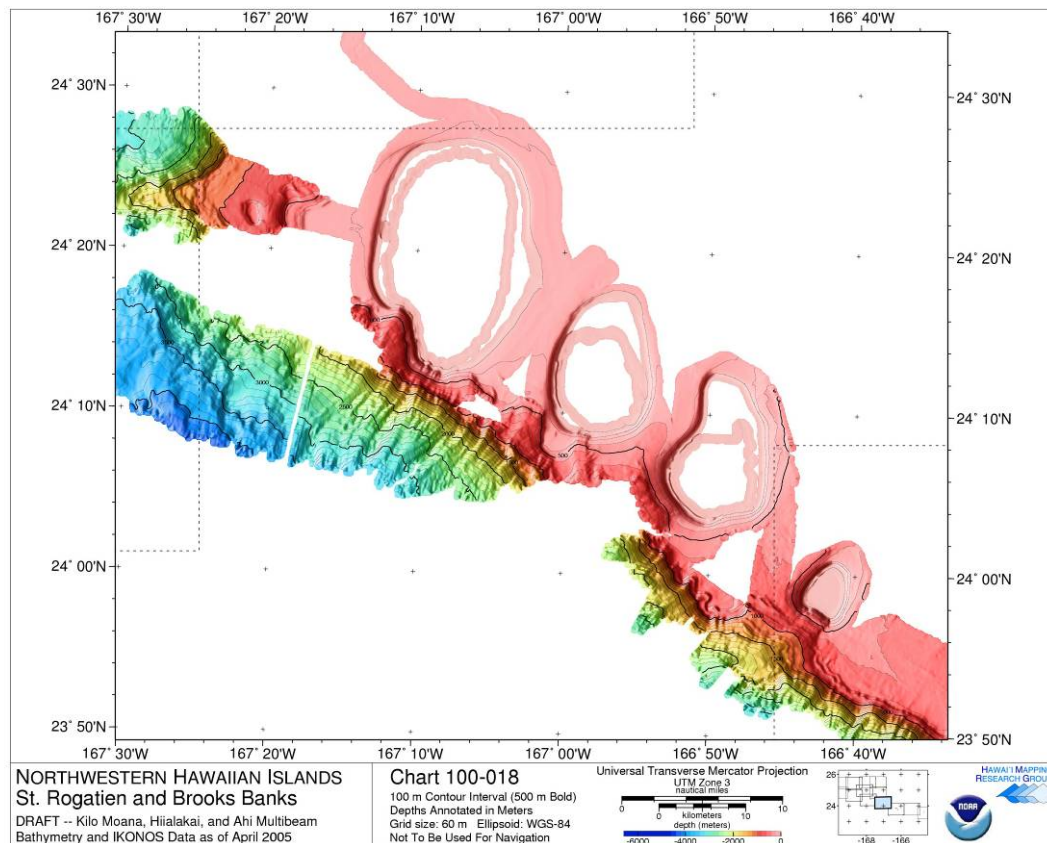


Figure B1-1. Existing 2002 and 2005 Multibeam Bathymetry at St. Rogatien and Brooks Banks before cruise HI0612.

Multibeam mapping was conducted between October 13 and October 21 at Middle Brooks, West Brooks and St. Rogatien Banks using the shipboard EM300 and EM3002D sonars. The R/V *AHI* was deployed on 5 days, but because of sea conditions and mechanical problems, only collected data on October 14, 2006. Bank top mapping

on Middle and West Brooks Banks was completed and 8 hours of mapping was done at St. Rogatien Bank (Fig. B1-2).

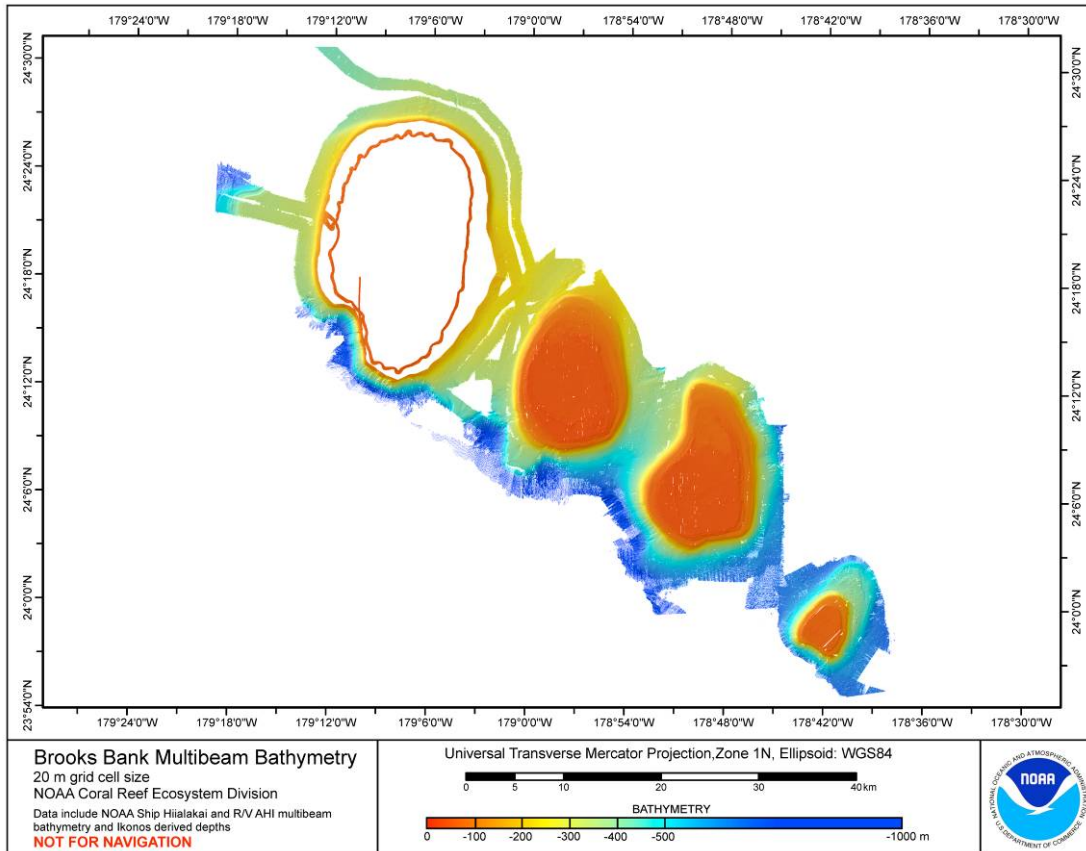


Figure B1-2: High resolution multibeam coverage at Brooks and St. Rogatien Banks after completion of cruise HI0612.

Between October 13 and October 21, 2006, 17 shipboard conductivity, temperature and depth casts were performed around Brooks Banks in conjunction with mapping efforts. These casts which ranged from 200 meters to 1000 meters also included fluorometry, turbidity, and dissolved oxygen measurements.

16

B.3 Bottomfish Digital Stereo-camera Bait System (BotCam) Deployments at Brooks Banks (*Danny Merritt, Jason Helyer, Kevin Lino, Frank Mancini*)

Between October 13 and October 18, 2006, a total of 20 BotCam drops were performed at Brooks Banks including 10 drops on Middle Brooks Bank (MBB), four drops on West Brooks Bank (WBB), and 6 drops on Saint Rogatien Bank (SRB). Drop depths ranged between approximately 70 and 290 meters. Technical problems on the first two drops on Middle Brooks Bank prevented bait release; therefore these drops are considered unbaited. These two sites were revisited the following day. Further technical problems led to immediate bait release upon recording for the remaining 12 drops on Middle Brooks Bank and West Brooks Bank. The technical issues were solved for the six drops on Saint Rogatien Bank; thus these drops included 10 to 15 minutes of unbaited video followed by 45 to 50 minutes of baited video. BotCam sites are shown in Figures B3-1 to B3-4 below, and habitat descriptions follow.

A total of 20 hours of video was collected and analyzed from the three neighboring banks. Fish were captured on 75 percent of the drops. At least 21 species of fish, including most of the commercially important target species were identified from the video (Table B3-1). The most commonly identified fish were kahala (*Seriola dumerili*), hapuupuu (*Epinephelus quernus*), ehu (*Etelis carbunculus*) and gindai (*Pristipomoides zonatus*), occurring at 60, 30, 20 and 20 percent of the drop sites, respectively.

All six of the drops at SRB captured fish on video, averaging six different species per drop. The most common species at SRB sites were hapuupuu at 83 percent of drop sites, kahala (83%), ehu (67%), gindai (50%), kalekale (*Pristipomoides sieboldii*) (33%) and yellowtail kale (*Pristipomoides auricilla*) (33%). Seven species were recorded at SRB005. Kalekale were the most numerous, followed by yellowtail kale, ehu, hapuupuu, and gindai. Analysis showed at least 14 different species were present at the SRB sites.

Six of the ten MBB drops captured fish. Site MBB003 was the richest drop site with at least 13 different species present, including a school of kahala containing more than 25 individuals, 8 onaga (*Etelis coruscans*), 5 gindai, a large hapuupuu, a school of small unknown fish, a shark, and an eel. The other MBB sites were less diverse, showing a few kahala and onaga, one opakapaka (*Pristipomoides filamentosus*), and a shark. Analysis of MBB sites also showed at least 14 different species present in the area, largely because of the diversity of species seen at MBB003.

Fish were captured on only one of the four WBB sites. Thirteen individual kahala, several opakapaka, and a devil ray (*Mobulae spp.*) were identified at WBB002.

Initial analysis of the video suggests that bottom fish are tied to not only the Essential Fish Habitat (EFH) depth range of 100 to 400 meters, but also to hard bottoms, steep slopes, and high rugosity and porosity three-dimensional bottom structure on the order of one-half a cubic meter to five cubic meters. Several target species including the Hawaiian grouper and ehu are readily attracted directly to the bait, while species such as

opakapaka, kalekale, yellowtail kale, gindai, kahala and butaguchi are generally seen in the background of the video.

Table B3-1. Fish species identified on Botcam video by drop site.

Site	Butaguchi	Ehu	Gindai	Hapuupuu	Kahala	Kalekale	Onaga	Opakapaka	Yellowtail kale	Shark spp.	Other
MBB001											
MBB002					X		X			X	
MBB003	X		X	X	X		X			X	X
MBB004											
MBB005					X						
MBB006					X						
MBB007					X						
MBB008					X			X			
MBB009											
MBB010											
WBB001											
WBB002					X			X			X
WBB003											
WBB004											
SRB001	X			X	X						X
SRB002		X		X		X			X		X
SRB003		X	X	X	X						X
SRB004					X						X
SRB005		X	X	X	X	X			X		X
SRB006		X	X	X	X						X

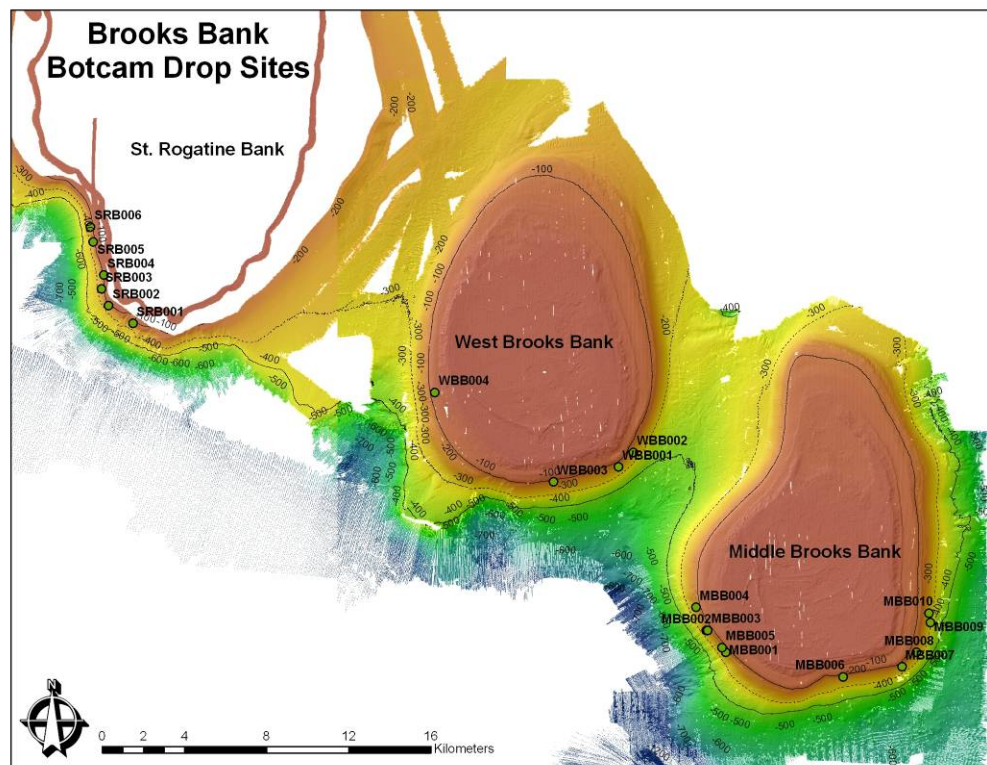


Figure B3-1. Location of Botcam Drops on St. Rogatien, West Brooks and Middle Brooks Banks.

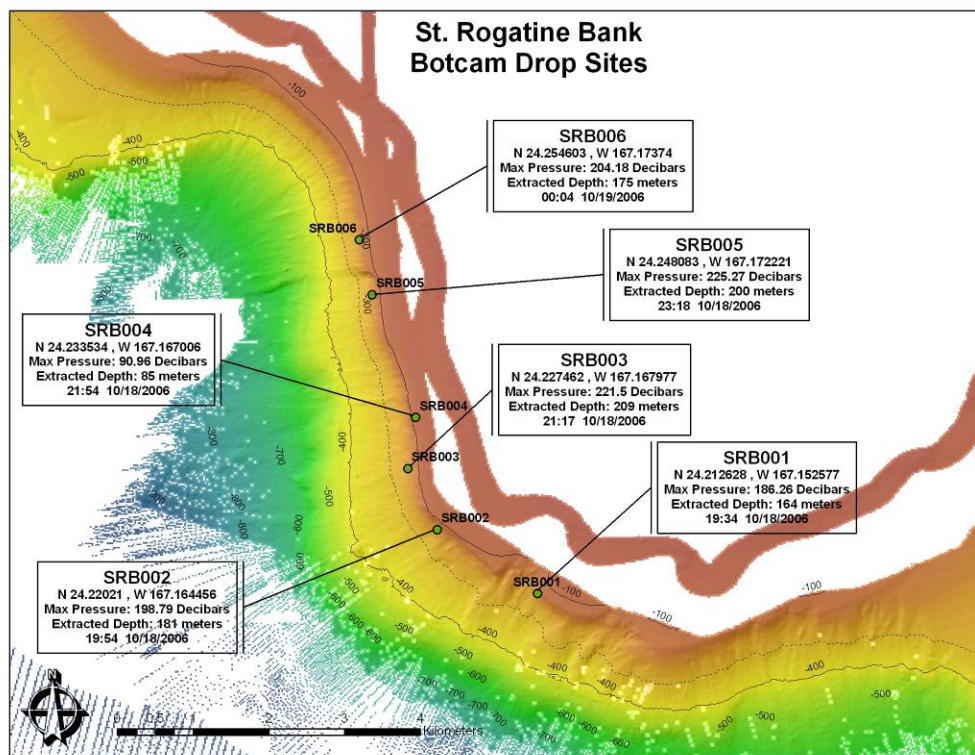


Figure B3-2. BotCam Drop Sites on St. Rogatien Bank.

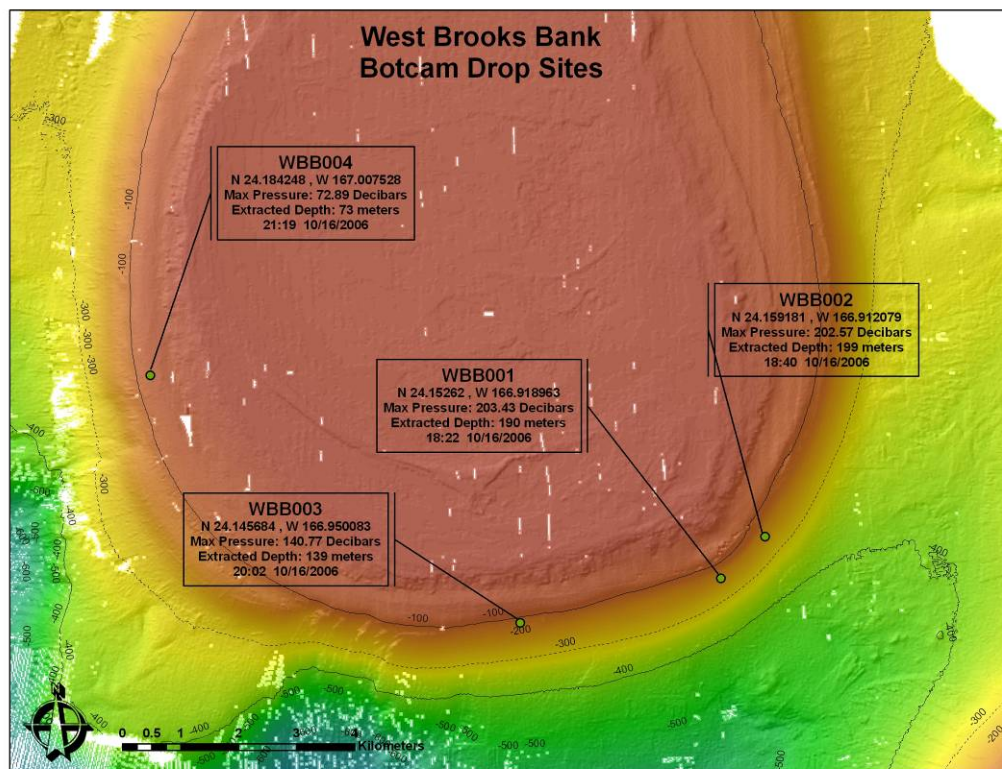


Figure B3-3. BotCam Drop Sites on West Brooks Bank.

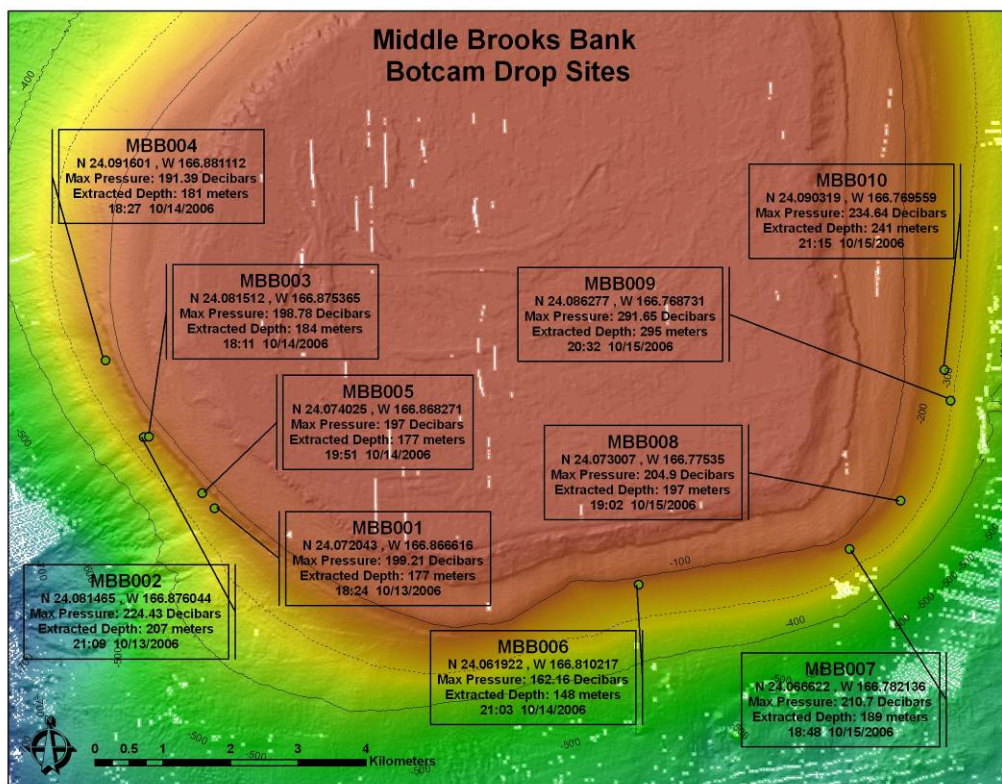


Figure B3-4. BotCam Drop Sites on Middle Brooks Bank.

Middle Brooks Bank (MBB)

MBB001

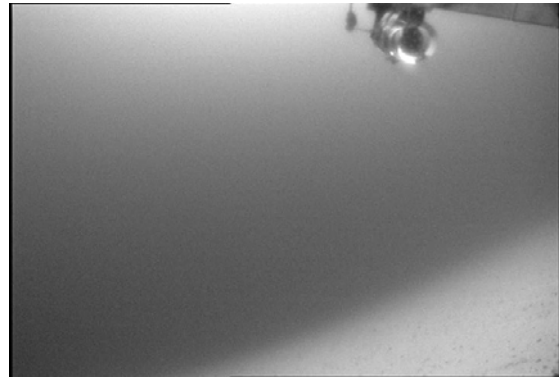
10/13/06

Bottom Description:

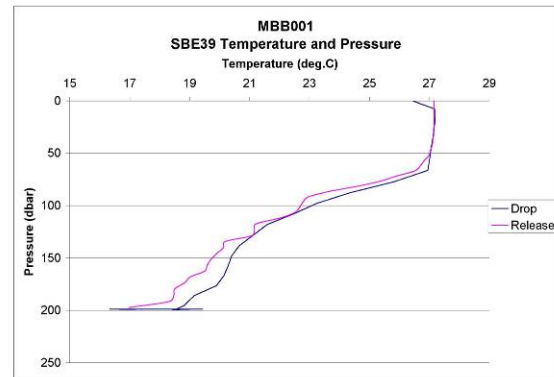
Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

No biological activity.



Latitude	N 24.072043
Longitude	W 166.866616
SBE pressure (decibars)	199.21
Derived depth (m)	177.65
Recorded start (min)	18:54:25
Bait release (min)	n/a
Recorded stop (min)	19:54:21
Recovery time (min)	19:54:00
Estimated slope (°)	30
Min. bottom temp. (°C)	16.34
Max. bottom temp. (°C)	19.43
Avg. bottom temp. (°C)	18.35



Middle Brooks Bank (MBB)

MBB002

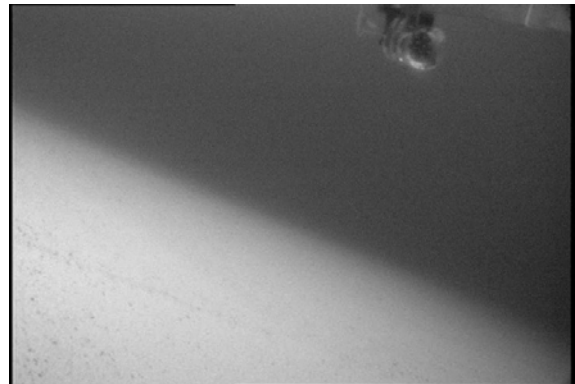
10/13/06

Bottom Description

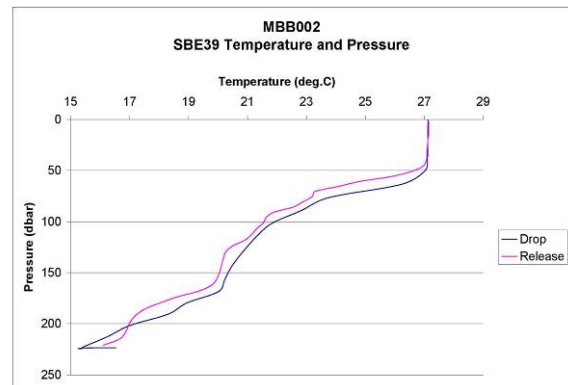
Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

Little biological activity, including one target species.



Latitude	N 24.072043
Longitude	W 166.866616
SBE pressure (decibars)	199.21
Derived depth (m)	177.65
Recorded start (min)	21:41:43
Bait release (min)	n/a
Recorded stop (min)	22:41:40
Recovery time (min)	19:54:00
Estimated slope (°)	30
Min. bottom temp. (°C)	16.34
Max. bottom temp. (°C)	19.43
Avg. bottom temp. (°C)	18.35



Middle Brooks Bank (MBB)

MBB003

10/14/06

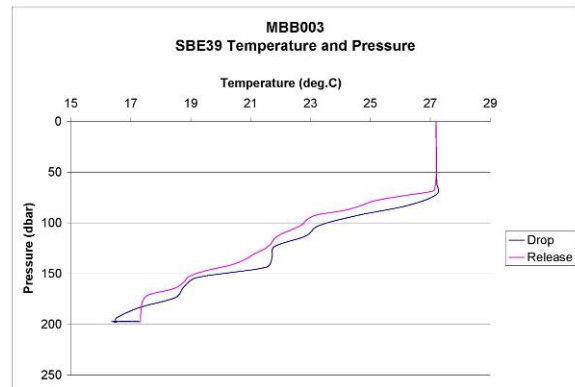
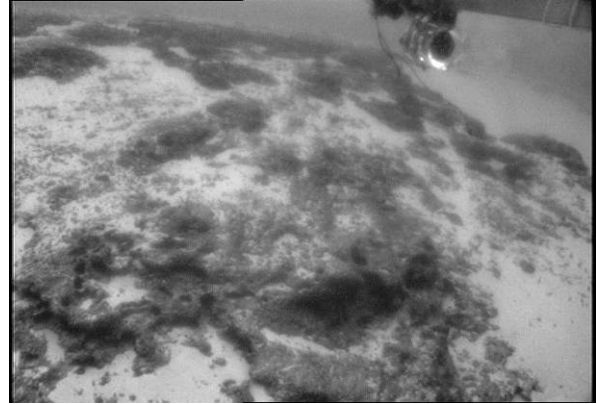
Bottom Description:

Hard bottom, rock substrate, some relief and high porosity.

Biological Description:

Dense biological activity, including three target species.

Latitude	N 24.081512
Longitude	W 166.875365
SBE pressure (decibars)	198.78
Derived depth (m)	184.36
Recorded start (min)	18:34:15
Bait release (min)	18:34:15
Recorded stop (min)	19:25:09
Recovery time (min)	19:32:00
Estimated slope (°)	35
Min. bottom temp. (°C)	16.36
Max. bottom temp. (°C)	17.33
Avg. bottom temp. (°C)	16.55



Middle Brooks Bank (MBB)

MBB004

10/14/06

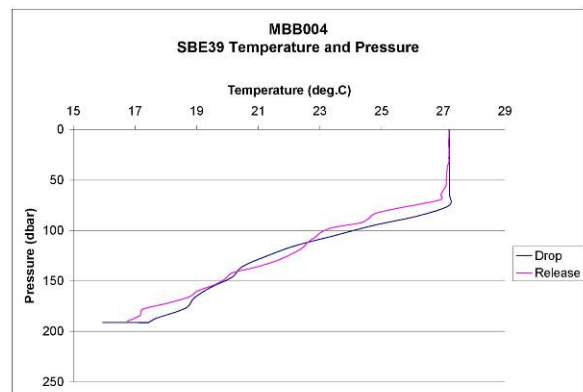
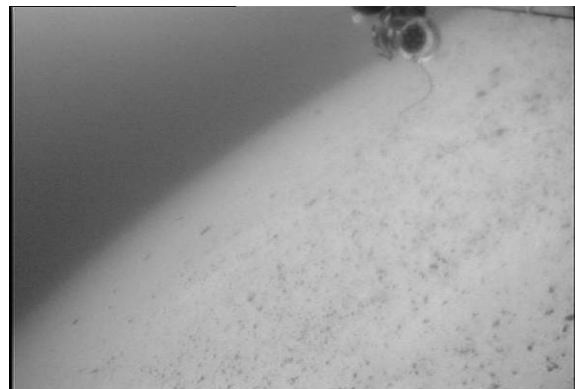
Bottom Description:

Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

No biological activity.

Latitude	N 24.091601
Longitude	W 166.881112
SBE pressure (decibars)	191.39
Derived depth (m)	207.90
Recorded start (min)	Error
Bait release (min)	Error
Recorded stop (min)	Error
Recovery time (min)	20:11:00
Estimated slope (°)	30
Min. bottom temp. (°C)	15.96
Max. bottom temp. (°C)	17.43
Avg. bottom temp. (°C)	17.01



Middle Brooks Bank (MBB)

MBB005

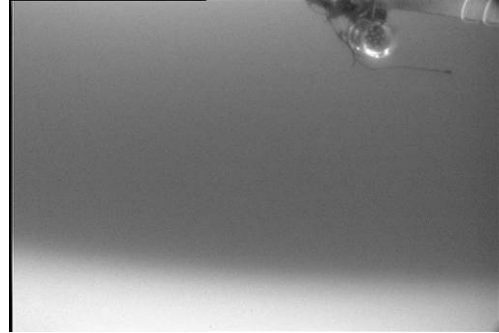
10/14/06

Bottom Description:

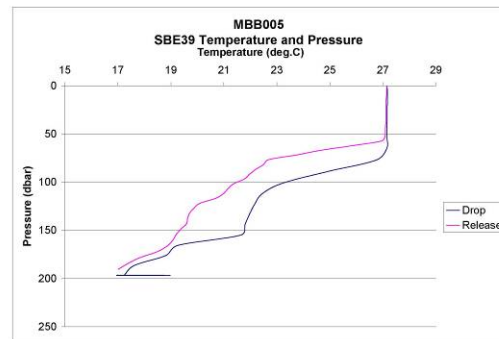
Hard bottom, smooth substrate, no relief and no porosity.

Biological Description:

Little biological activity. No target species.



Latitude	N 24.074025
Longitude	W 166.868271
SBE pressure (decibars)	197.00
Derived depth (m)	177.60
Recorded start (min)	20:20:17
Bait release (min)	20:21:12
Recorded stop (min)	21:20:13
Recovery time (min)	22:57:00
Estimated slope (°)	5
Min. bottom temp. (°C)	16.95
Max. bottom temp. (°C)	18.97
Avg. bottom temp. (°C)	17.59



Middle Brooks Bank (MBB)

MBB006

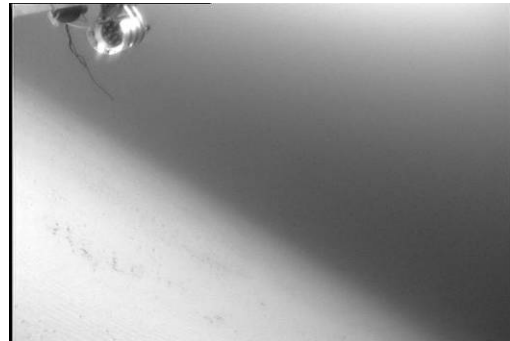
10/14/06

Bottom Description:

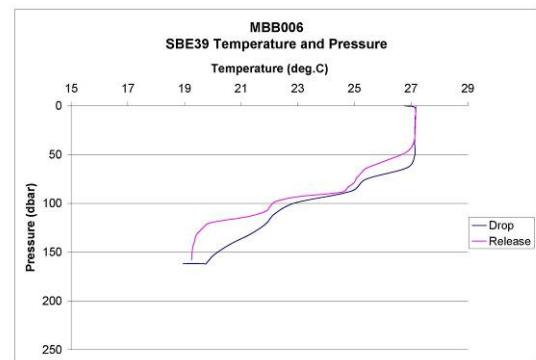
Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

Little biological activity. No target species.



Latitude	N 24.061922
Longitude	W 166.810217
SBE pressure (decibars)	162.16
Derived depth (m)	148.64
Recorded start (min)	error
Bait release (min)	error
Recorded stop (min)	error
Recovery time (min)	22:27:00
Estimated slope (°)	40
Min. bottom temp. (°C)	18.95
Max. bottom temp. (°C)	19.75
Avg. bottom temp. (°C)	19.21



Middle Brooks Bank (MBB)

MBB007

10/15/06

Bottom Description:

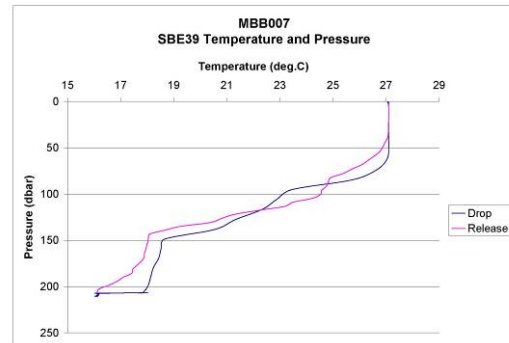
Hard bottom, loose substrate, some relief and no porosity.

Biological Description:

Little biological activity. No target species.



Latitude	N 24.066622
Longitude	W 166.782136
SBE pressure (decibars)	210.7
Derived depth (m)	189.50
Recorded start (min)	19:06:28
Bait release (min)	19:59:35
Recorded stop (min)	20:06:21
Recovery time (min)	20:08:00
Estimated slope (°)	40
Min. bottom temp. (°C)	16.02
Max. bottom temp. (°C)	18.02
Avg. bottom temp. (°C)	16.45



Middle Brooks Bank (MBB)

MBB008

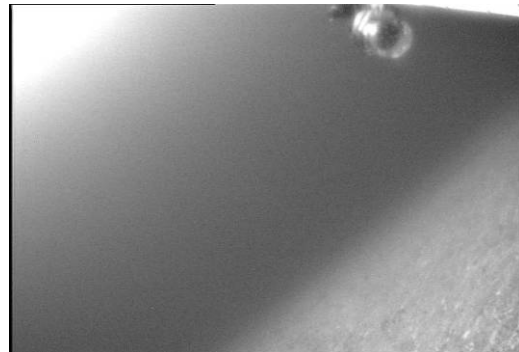
10/15/06

Bottom Description:

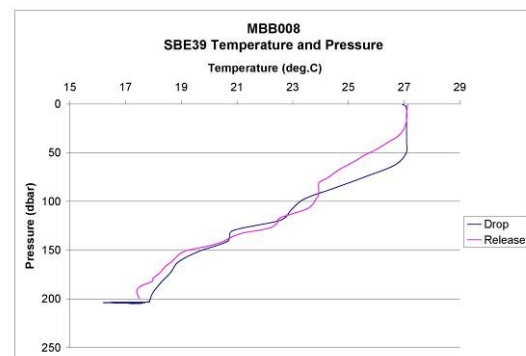
Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

Little biological activity, including one target species.



Latitude	N 24.073007
Longitude	W 166.77535
SBE pressure (decibars)	234.64
Derived depth (m)	241.96
Recorded start (min)	19:19:23
Bait release (min)	n/a
Recorded stop (min)	20:19:19
Recovery time (min)	20:53:00
Estimated slope (°)	n/a
Min. bottom temp. (°C)	16.20
Max. bottom temp. (°C)	17.87
Avg. bottom temp. (°C)	15.52



Middle Brooks Bank (MBB)

MBB009

10/15/06

Bottom Description:

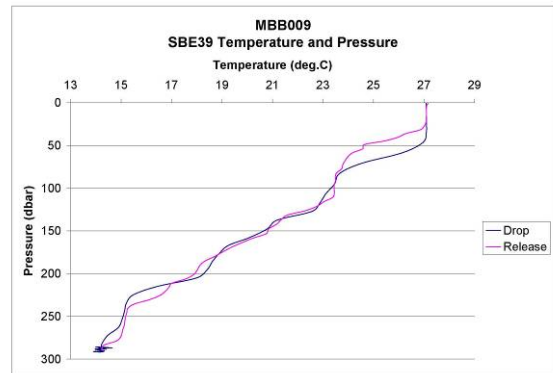
Hard bottom, loose substrate, some relief and no porosity.

Biological Description:

No biological activity.



Latitude	N 24.086277
Longitude	W 166.768731
SBE pressure (decibars)	291.65
Derived depth (m)	295.10
Recorded start (min)	20:53:34
Bait release (min)	20:53:34
Recorded stop (min)	21:53:29
Recovery time (min)	22:10:00
Estimated slope (°)	40
Min. bottom temp. (°C)	13.91
Max. bottom temp. (°C)	14.65
Avg. bottom temp. (°C)	14.21



Middle Brooks Bank (MBB)

MBB010

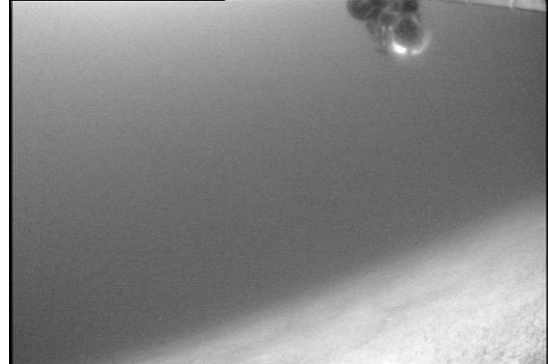
10/14/06

Bottom Description:

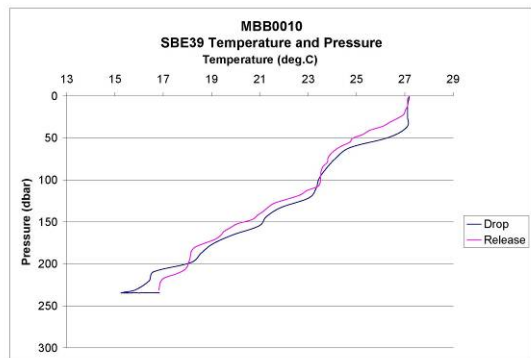
Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

No biological activity.



Latitude	N 24.090319
Longitude	W 166.769559
SBE pressure (decibars)	234.64
Derived depth (m)	241.96
Recorded start (min)	21:20:20
Bait release (min)	21:22:50
Recorded stop (min)	22:07:38
Recovery time (min)	22:43:00
Estimated slope (°)	10
Min. bottom temp. (°C)	15.25
Max. bottom temp. (°C)	16.83
Avg. bottom temp. (°C)	15.52



West Brooks Bank (WBB)

WBB001

10/16/06

Bottom Description:

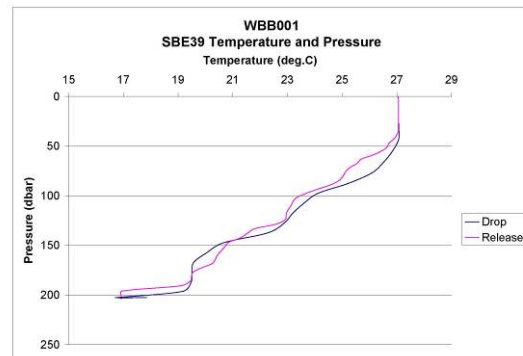
Hard bottom, loose substrate, some relief and no porosity.

Biological Description:

No biological activity.



Latitude	N 24.152620
Longitude	W 166.918963
SBE pressure (decibars)	203.43
Derived depth (m)	190.89
Recorded start (min)	18:40:02
Bait release (min)	18:41:04
Recorded stop (min)	19:27:45
Recovery time (min)	19:38:00
Estimated slope (°)	10-15
Min. bottom temp. (°C)	16.70
Max. bottom temp. (°C)	17.85
Avg. bottom temp. (°C)	16.93



West Brooks Bank (WBB)

WBB002

10/16/06

Bottom Description:

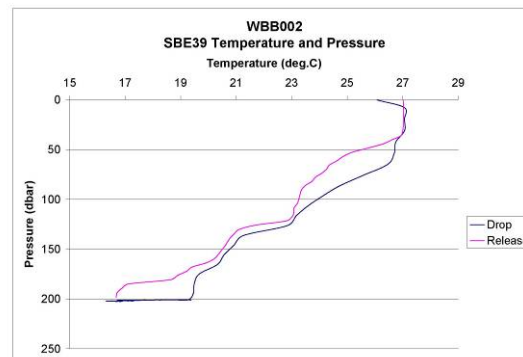
Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

Little biological activity, including one target species.



Latitude	N 24.159181
Longitude	W 166.912079
SBE pressure (decibars)	202.57
Derived depth (m)	199.19
Recorded start (min)	18:55:03
Bait release (min)	18:58:22
Recorded stop (min)	19:55:00
Recovery time (min)	20:30:00
Estimated slope (°)	40
Min. bottom temp. (°C)	16.31
Max. bottom temp. (°C)	19.37
Avg. bottom temp. (°C)	17.04



West Brooks Bank (WBB)**WBB003**

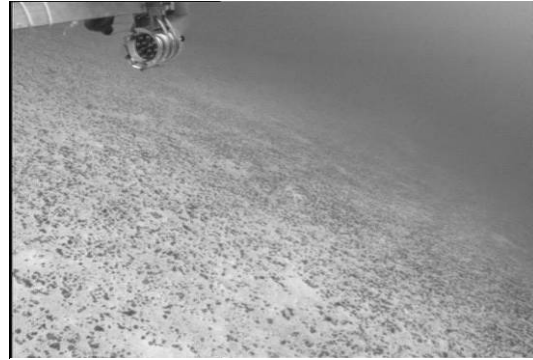
10/16/06

Bottom Description:

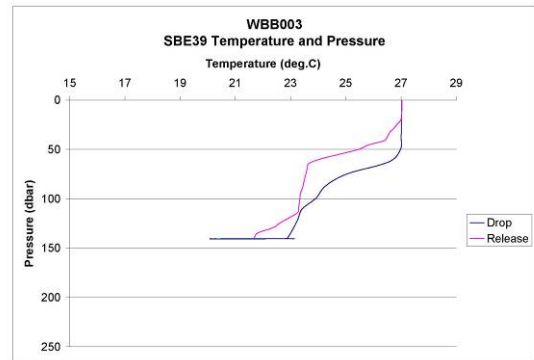
Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

No biological activity.



Latitude	N 24.145684
Longitude	W 166.950083
SBE pressure (decibars)	140.77
Derived depth (m)	
Recorded start (min)	20:24:59
Bait release (min)	20:24:59
Recorded stop (min)	21:24:56
Recovery time (min)	22:23:00
Estimated slope (°)	20-30
Min. bottom temp. (°C)	20.08
Max. bottom temp. (°C)	23.14
Avg. bottom temp. (°C)	21.84

**West Brooks Bank (WBB)****WBB004**

10/16/06

Bottom Description:

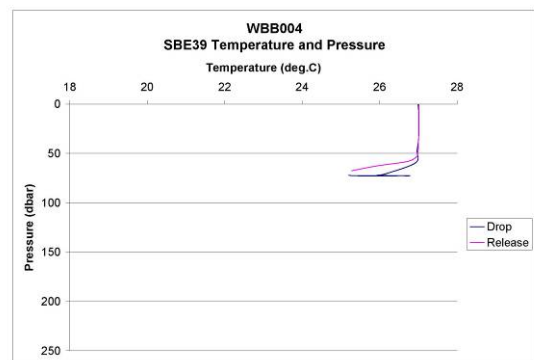
Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

Little biological activity. No target species



Latitude	N 24.184248
Longitude	W 167.007528
SBE pressure (decibars)	72.89
Derived depth (m)	
Recorded start (min)	21:40:06
Bait release (min)	21:40:06
Recorded stop (min)	22:39:59
Recovery time (min)	22:41
Estimated slope (°)	0-5
Min. bottom temp. (°C)	25.20
Max. bottom temp. (°C)	26.78
Avg. Bottom Temp. (°C)	26.26



St. Rogatien Bank (SRB)**SRB001**

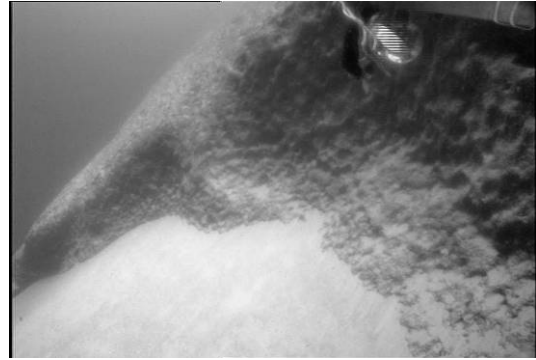
10/18/06

Bottom Description:

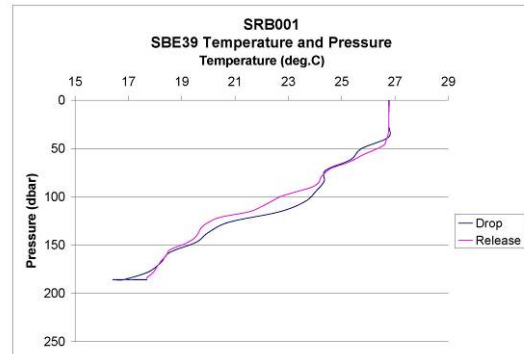
Hard bottom, sand/rock substrate, some relief and little porosity.

Biological Description:

Medium biological activity, including one target species.



Latitude	N 24.212628
Longitude	W 167.152577
SBE pressure (decibars)	186.26
Derived depth (m)	
Recorded start (min)	19:52:29
Bait release (min)	20:09:21
Recorded stop (min)	20:48:28
Recovery time (min)	20:57:00
Estimated slope (°)	50-60
Min. bottom temp. (°C)	16.42
Max. bottom temp. (°C)	17.69
Avg. bottom temp. (°C)	17.17

**St. Rogatien Bank (SRB)****SRB002**

10/18/06

Bottom Description:

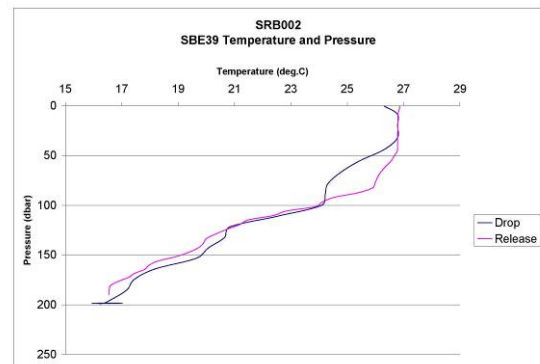
Hard bottom, loose substrate, no relief and moderate porosity.

Biological Description:

Dense biological activity, including four target species.



Latitude	N 24.220210
Longitude	W 167.164456
SBE pressure (decibars)	198.79
Derived depth (m)	
Recorded start (min)	20:12:34
Bait release (min)	20:23:42
Recorded stop (min)	21:12:31
Recovery time (min)	21:41:00
Estimated slope (°)	n/a
Min. bottom temp. (°C)	15.94
Max. bottom temp. (°C)	17.01
Avg. bottom temp. (°C)	16.59



St. Rogatien Bank (SRB)

SRB003

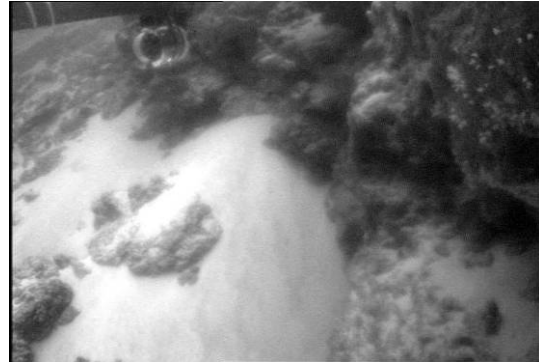
10/18/06

Bottom Description:

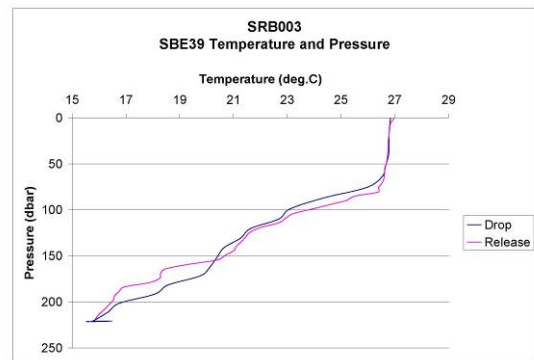
Rocky ledge on shelf with diverse relief and high porosity.

Biological Description:

Dense biological activity, including three target species.



Latitude	N 24.227462
Longitude	W 167.167977
SBE pressure (decibars)	221.50
Derived depth (m)	
Recorded start (min)	21:40:45
Bait release (min)	21:56:46
Recorded stop (min)	22:40:40
Recovery time (min)	22:51:00
Estimated slope (°)	n/a
Min. bottom temp. (°C)	15.54
Max. bottom temp. (°C)	16.47
Avg. bottom temp. (°C)	16.17



St. Rogatien Bank (SRB)

SRB004

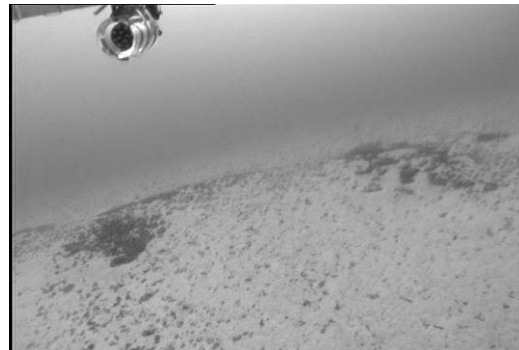
10/18/06

Bottom Description:

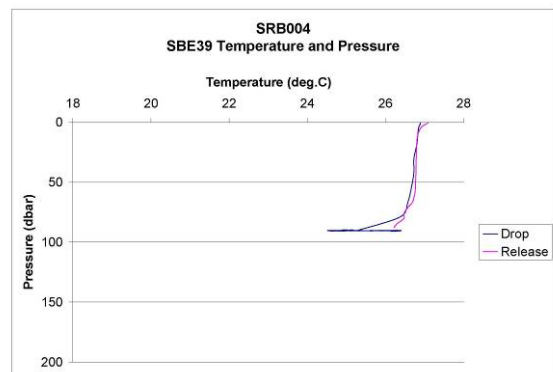
Hard bottom, loose substrate, no relief and no porosity.

Biological Description:

Little biological activity. No target species.



Latitude	N 24.233534
Longitude	W 167.167006
SBE pressure (decibars)	90.96
Derived depth (m)	
Recorded start (min)	22:18:12
Bait release (min)	22:29:59
Recorded stop (min)	23:18:04
Recovery time (min)	error
Estimated slope (°)	5
Min. bottom temp. (°C)	24.52
Max. bottom temp. (°C)	26.40
Avg. bottom temp. (°C)	25.61



St. Rogatien Bank (SRB)**SRB005**

10/18/06

Bottom Description:

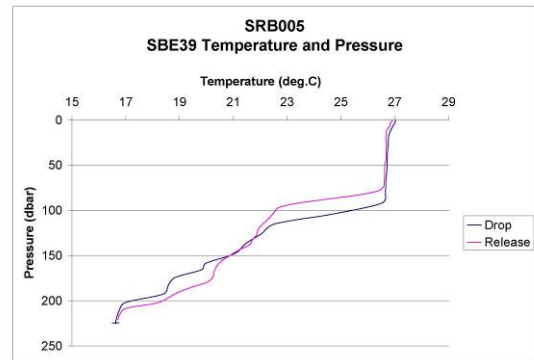
Hard bottom, loose substrate, some relief and low porosity.

Biological Description:

Dense biological activity, including five target species.



Latitude	N 24.248083
Longitude	W 167.172221
SBE pressure (decibars)	225.27
Derived depth (m)	
Recorded start (min)	23:41:14
Bait release (min)	00:01:59
Recorded stop (min)	00:37:16
Recovery time (min)	00:49:00
Estimated slope (°)	10-15
Min. bottom temp. (°C)	16.50
Max. bottom temp. (°C)	16.75
Avg. bottom temp. (°C)	16.63

**St. Rogatien Bank (SRB)****SRB006**

10/18/06

Bottom Description:

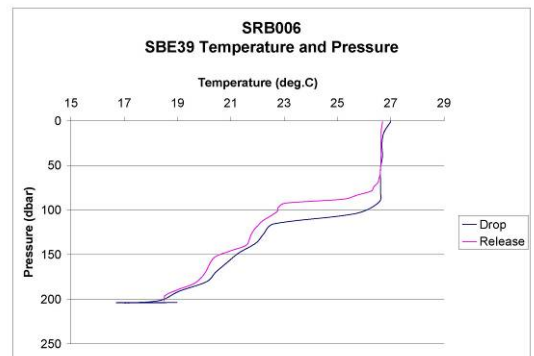
Hard bottom, loose substrate with some relief and moderate porosity.

Biological Description:

Dense biological activity, including three target species.



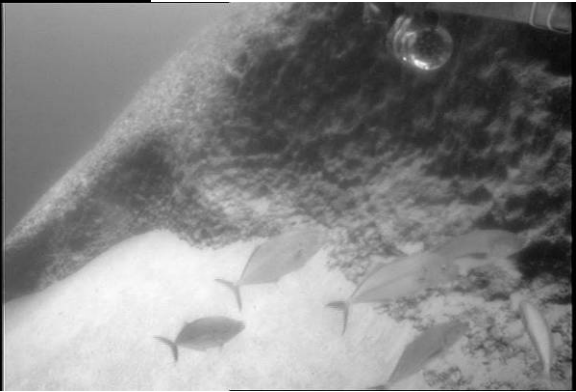
Latitude	N 24.254603
Longitude	W 167.173740
SBE pressure (decibars)	204.18
Derived depth (m)	
Recorded start (min)	26:16:00
Bait release (min)	00:40:30
Recorded stop (min)	1:24:42
Recovery time (min)	01:33:00
Estimated slope (°)	50-60
Min. bottom temp. (°C)	16.70
Max. bottom temp. (°C)	18.97
Avg. bottom temp. (°C)	18.04



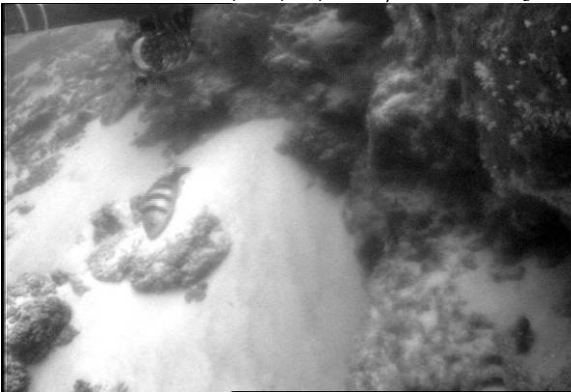
Sample Frame Grabs



Hawaiian Grouper, *Epinephalus quernus*



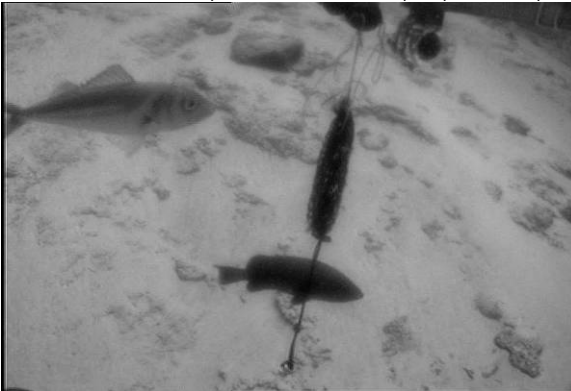
Butaguchi, *Pseudocaranx dentex*



Gindai, *Pristipomoides zonatus*



Opakapaka, *Pristipomoides filamentosus*



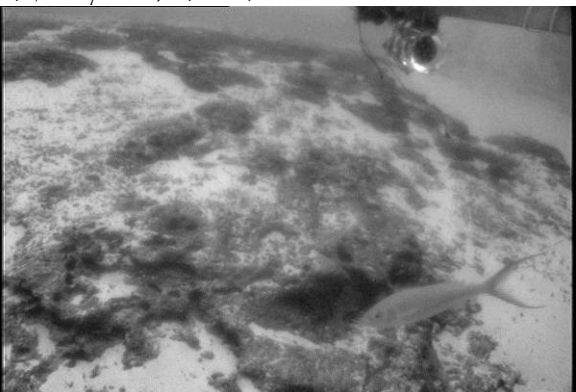
Ehu, *Etalis carbunculus*



Yellowtail Kale, *Pristipomoides auricilla*



Kalekale, *Pristipomoides sieboldii*



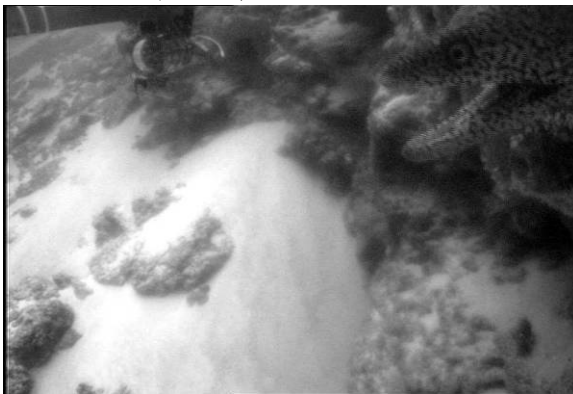
Onaga, *Etalis coruscans*



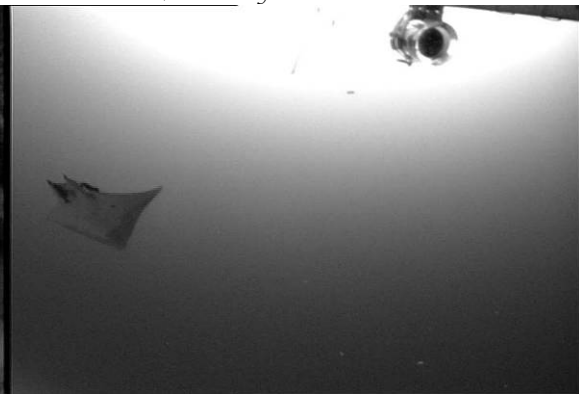
Kahala, *Seriola dumerili*



Black Jack (Ulua), *Caranx lugubris*



Gymnothorax sp



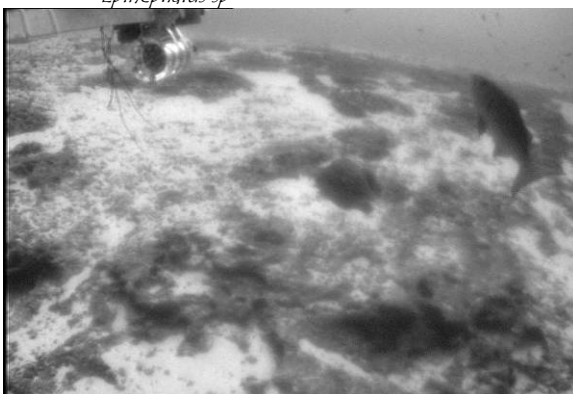
Devil Ray, *Mobula* sp



Epinephalus sp



Unidentified species



Unidentified species



Hawaiian Grouper, *Epinephalus quernus*

Appendix C: West Nihoa Bank

Multibeam, conductivity-temperature-depth (CTD), and bottomfish digital stereo-camera bait system (BotCam) operations were conducted on West Nihoa Bank from October 23 to October 27, 2006.

C.1 Multibeam Mapping

Approximately 50 percent of the West Nihoa banktop was mapped using the shipboard EM3002D and EM300 sonars. Figure C1.1 shows multibeam coverage on West Nihoa Bank and around Nihoa Island, including data collected in 2002 and 2005. Figure C1-2 presents a close-up of an area from the southern portion of West Nihoa Bank; this close-up provides detail of potentially coral-rich areas in 30- to 200-m water depths.

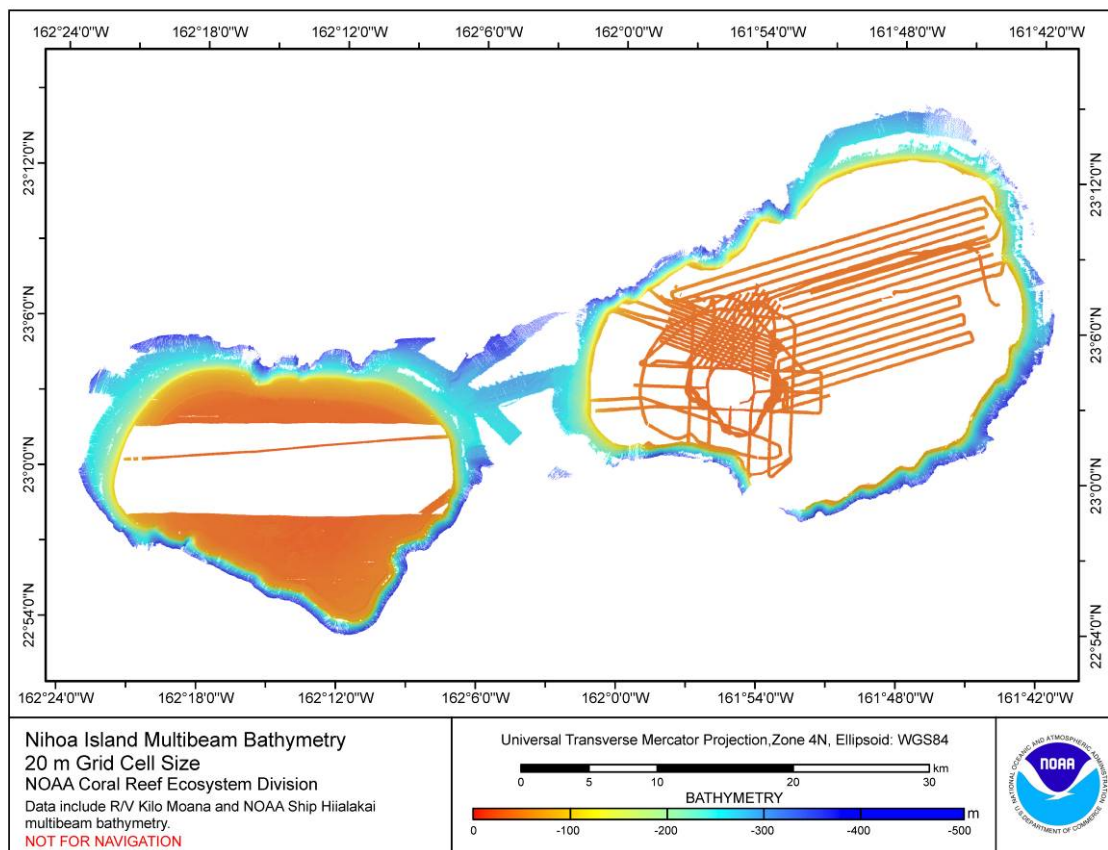


Figure C1-1. Multibeam coverage on Nihoa and West Nihoa Banks. Data on West Nihoa Bank were collected in 2002 and on HI0612, while data around Nihoa Island (eastern bank) were collected in 2002 and 2005.

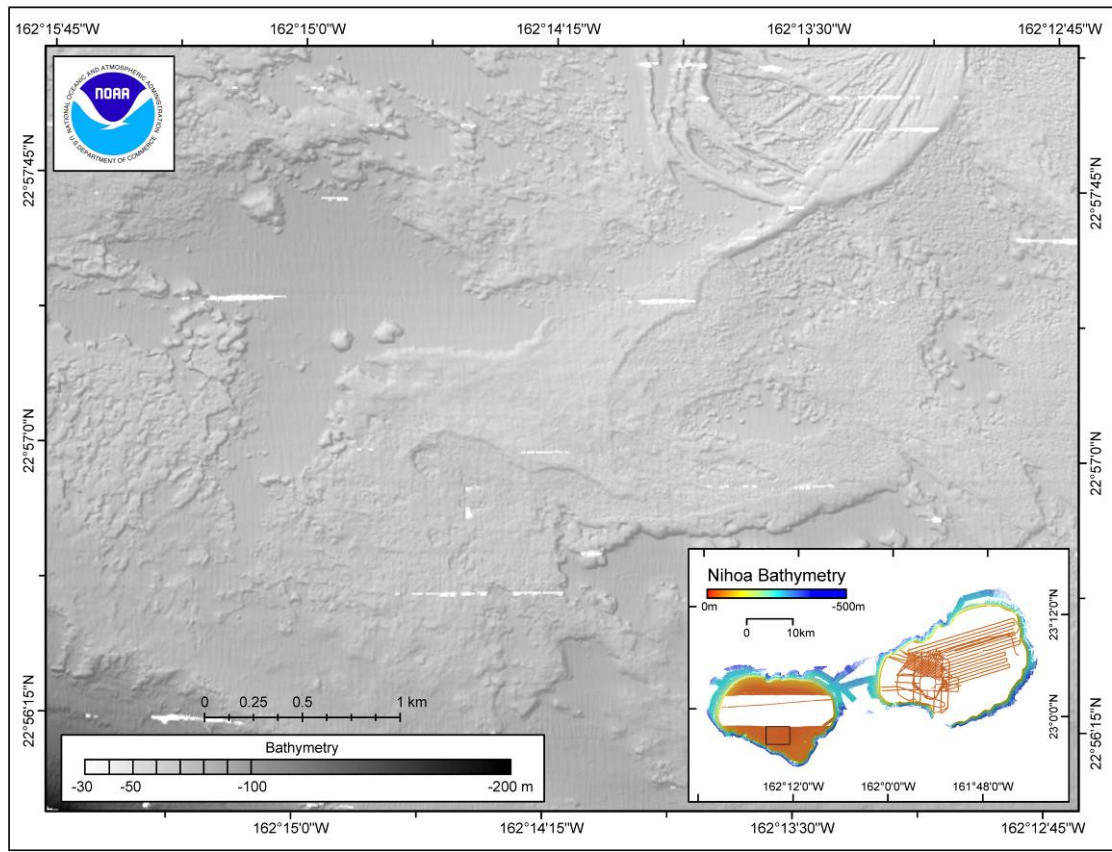


Figure C1-2. Close-up view of data from the southern part of West Nihoa Bank. This 5-m grid provides detail of complex bank-top morphology in water depths ranging from 30 to 200 m.

C.2 West Nihoa Bank Oceanography

Between October 24 and October 27, 2006, eight shipboard conductivity, temperature and depth casts (CTD) were performed around Nihoa Island in conjunction with mapping efforts. These casts which ranged from 200 meters to 400 meters also included fluorometry, turbidity, and dissolved oxygen measurements. Figure C2-1 below shows the location of the casts around the west bank of Nihoa Island.

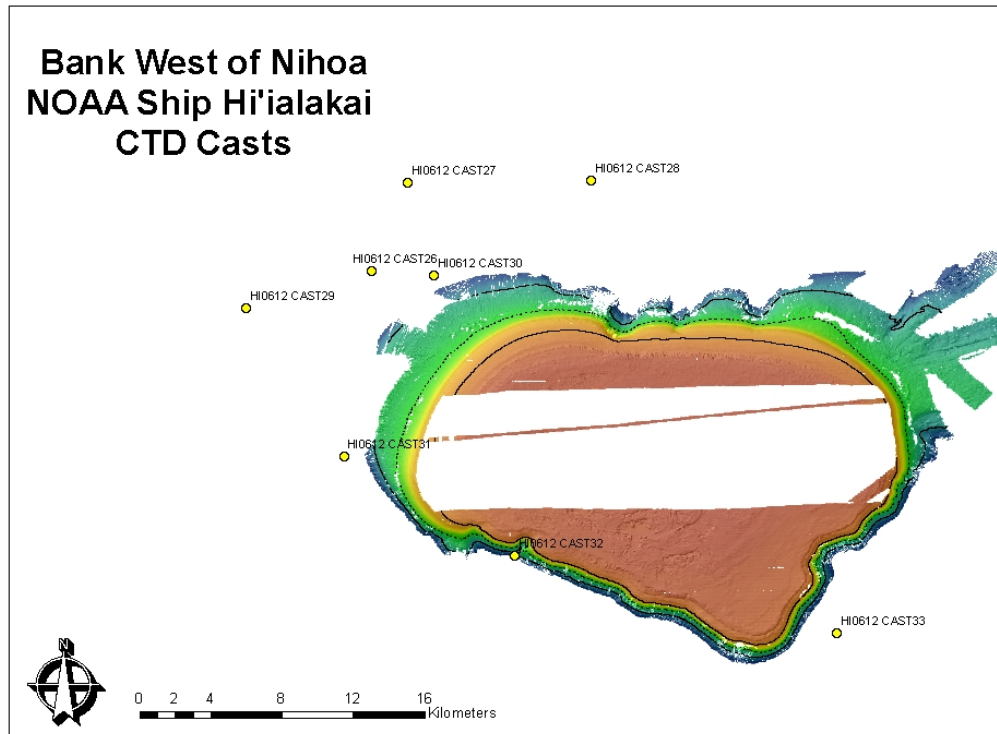


Figure C2-1. Map of CTDs performed at Brooks Banks during HI0612.

C.3 Bottomfish Digital Stereo-camera Bait System (BotCam) Deployments at Nihoa *(Danny Merritt, Jason Helyer, Kevin Lino, and Frank Mancini)*

Between October 25 and October 27, 2006, a total of 16 BotCam drops were performed at Nihoa Island (NIH). Drop depths ranged between approximately 130 and 330 meters. Technical problems on drops NIH005 and NIH006 prevented bait release therefore these drops are considered unbaited. All other drops included 12 to 15 minutes of unbaited video footage followed by 45 to 48 minutes of baited video footage. BotCam sites are shown in Figure C3-1 below, and habitat descriptions follow.

A total of 16 hours of video were collected and analyzed from the bank west of Nihoa Island. Fish were captured on 100% of the drops. At least nine species of fish, including several of the commercially important target species were identified from the video (Table 1). The most commonly identified fish were ehu (*Etelis carbunculus*), onaga (*Etelis coruscans*) and kalekale (*Pristipomoides sieboldii*), occurring at 75, 50, and 38 percent of the drop sites, respectively.

Species richness was highest at NIH013 with at least seven different species present, including a school of ehu containing more than 25 individuals, 15 kalekale, 5 gindai (*Pristipomoides zonatus*), and 2 onaga. Approximately 100 individual fish were noted at NIH011, including at least 50 ehu, 25 kalekale, and 20 butaguchi. Also worth noting, a large unidentified fish species was present which scared away a large school of fish at NIH016, and a manta ray was captured on video at NIH001.

Table C3-1. Fish species identified on BotCam video by drop site.

Site	Butaguchi	Ehu	Gindai	Hapuupuu	Kahala	Kalekale	Onaga	Opakapaka	Yellowtail kale	Shark spp.	Other
NIH001											X
NIH002					X						
NIH003					X						
NIH004											X
NIH005		X									X
NIH006		X					X				X
NIH007		X				X	X				
NIH008		X									X
NIH009		X									
NIH010		X				X	X				
NIH011	X	X	X			X					X
NIH012		X					X				
NIH013		X	X			X	X				X
NIH014		X	X			X	X				
NIH015		X					X				
NIH016		X	X			X	X				

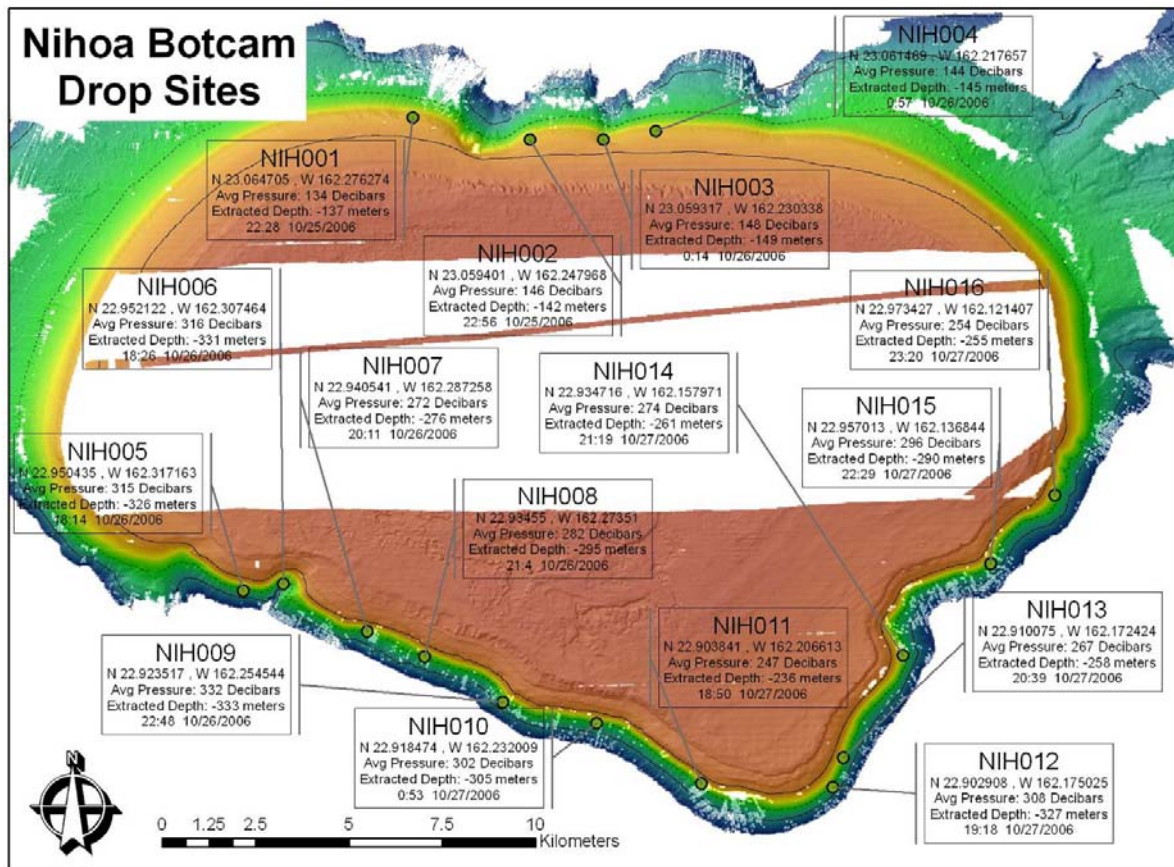


Figure C3-1. Location of BotCam Drops on Nihoa.

Nihoa (NIH)**NIH001**

10/25/06

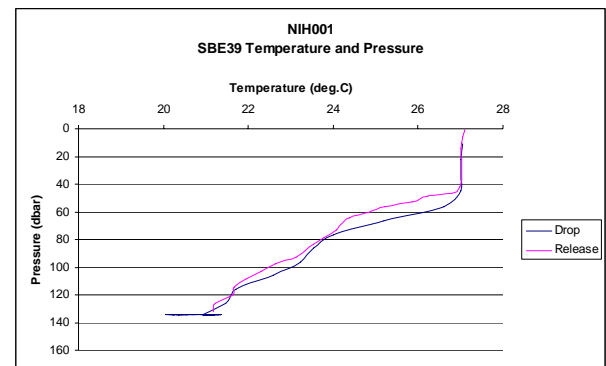
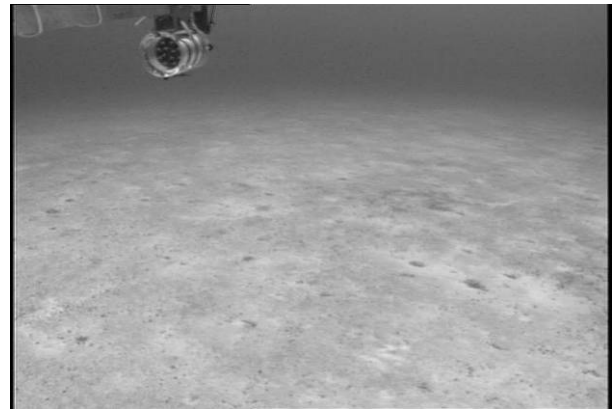
Bottom Description:

Hard bottom, loose substrate, no relief.

Biological Description:

Little biological activity, no target species.

Latitude	N 23.06470
Longitude	W 162.27628
SBE pressure (decibars)	134.17
Derived depth (m)	137
Recorded start (min)	22:40:16
Bait release (min)	22:53:33
Recorded stop (min)	23:30:09
Recovery time (min)	23:40:00
Estimated slope (°)	5
Min. bottom temp. (°C)	20.06
Max. bottom temp. (°C)	21.35
Avg. bottom temp. (°C)	20.85

**Nihoa (NIH)****NIH002**

10/25/06

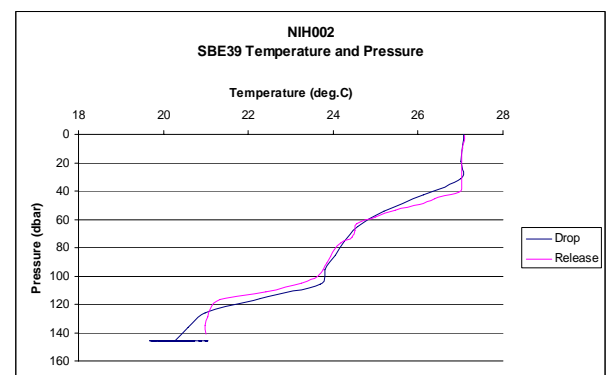
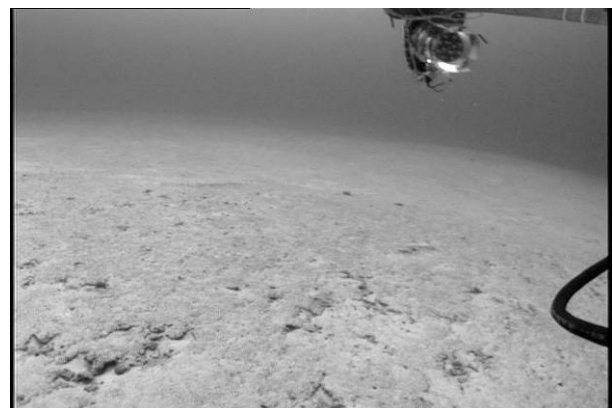
Bottom Description

Hard bottom, loose substrate, some relief.

Biological Description:

Little biological activity, no target species.

Latitude	N 23.06470
Longitude	W 162.24797
SBE pressure (decibars)	145.87
Derived depth (m)	142
Recorded start (min)	23:11:31
Bait release (min)	23:24:03
Recorded stop (min)	0:04:29
Recovery time (min)	0:34:00
Estimated slope (°)	5
Min. bottom temp. (°C)	19.69
Max. bottom temp. (°C)	21.04
Avg. bottom temp. (°C)	20.42



Nihoa (NIH)**NIH003**

10/25/06

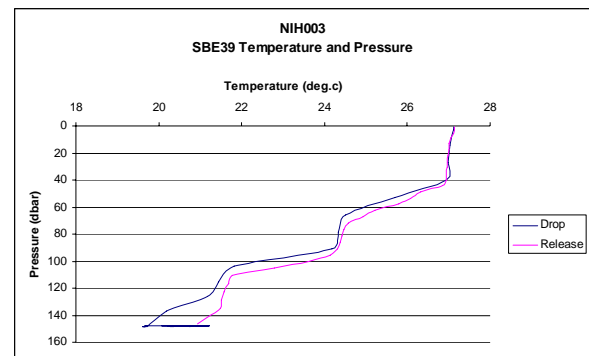
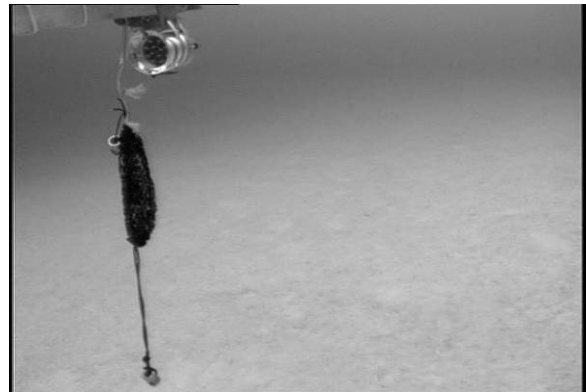
Bottom Description:

Hard bottom, loose substrate, some relief.

Biological Description:

Little biological activity, no target species.

Latitude	N 23.05932
Longitude	W 162.23033
SBE pressure (decibars)	148.09
Derived depth (m)	149
Recorded start (min)	1:19:06
Bait release (min)	1:33:25
Recorded stop (min)	2:21:27
Recovery time (min)	2:21:00
Estimated slope (°)	10-15
Min. bottom temp. (°C)	20.79
Max. bottom temp. (°C)	21.44
Avg. bottom temp. (°C)	21.18

**Nihoa (NIH)****NIH004**

10/25/06

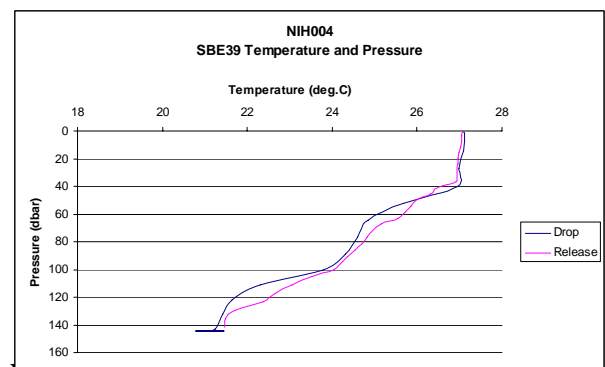
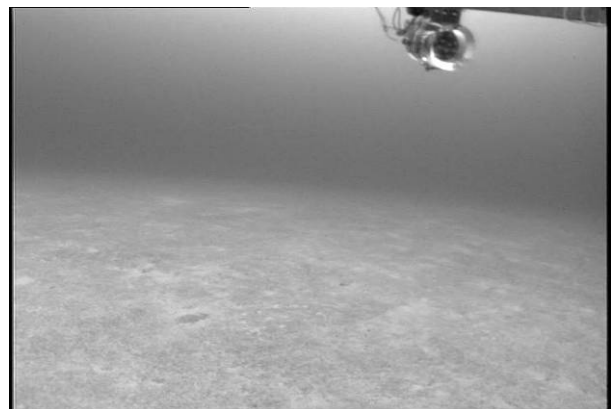
Bottom Description

Hard bottom, smooth substrate, some relief.

Biological Description:

Little biological activity, no target species.

Latitude	N 23.06147
Longitude	W 162.21765
SBE pressure (decibars)	144.24
Derived depth (m)	145
Recorded start (min)	1:19:06
Bait release (min)	1:33:25
Recorded stop (min)	2:21:27
Recovery time (min)	2:21:00
Estimated slope (°)	10-15
Min. bottom temp. (°C)	20.79
Max. bottom temp. (°C)	21.44
Avg. bottom temp. (°C)	21.18

**Nihoa (NIH)**

NIH005

10/26/06

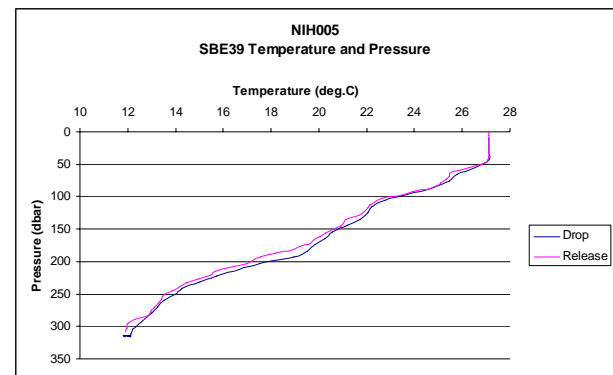
Bottom Description:

Hard bottom, dark boulders, loose substrate, some relief.

Biological Description:

Little biological activity, including one target species.

Latitude	N 22.95044
Longitude	W 162.31717
SBE pressure (decibars)	315.00
Derived depth (m)	326
Recorded start (min)	18:24:44
Bait release (min)	n/a
Recorded stop (min)	19:23:20
Recovery time (min)	19:37:00
Estimated slope (°)	30
Min. bottom temp. (°C)	11.82
Max. bottom temp. (°C)	12.13
Avg. bottom temp. (°C)	12.03

**Nihoa (NIH)****NIH006**

10/26/06

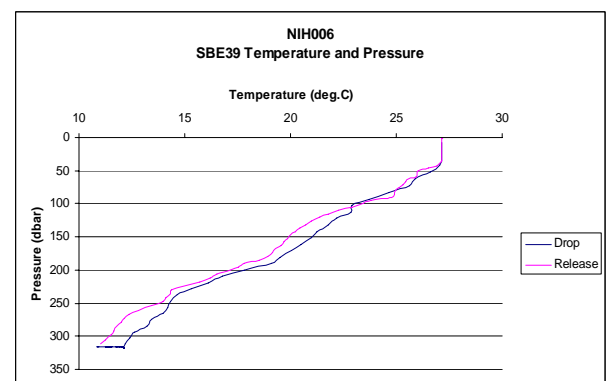
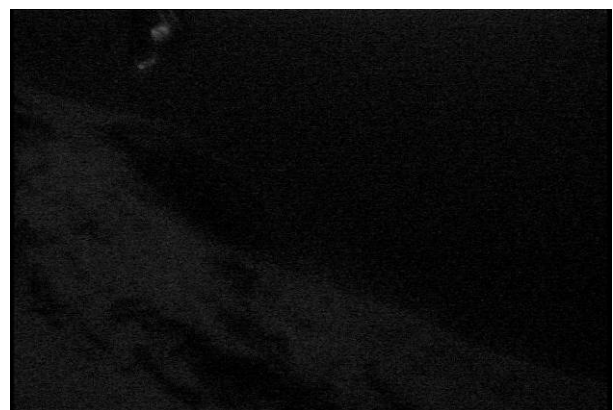
Bottom Description

Hard bottom, dark boulders, loose substrate, some relief.

Biological Description:

Some biological activity, including two target species.

Latitude	N 22.95212
Longitude	W 162.30746
SBE pressure (decibars)	316.34
Derived depth (m)	331
Recorded start (min)	18:44:31
Bait release (min)	19:01:00
Recorded stop (min)	19:44:29
Recovery time (min)	20:35:00
Estimated slope (°)	40
Min. bottom temp. (°C)	10.86
Max. bottom temp. (°C)	12.13
Avg. bottom temp. (°C)	11.80



Nihoa (NIH)**NIH007**

10/26/06

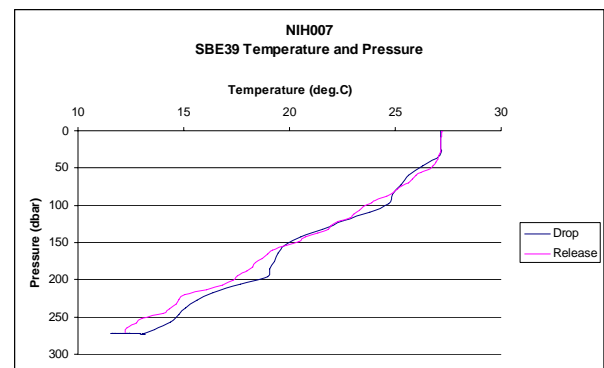
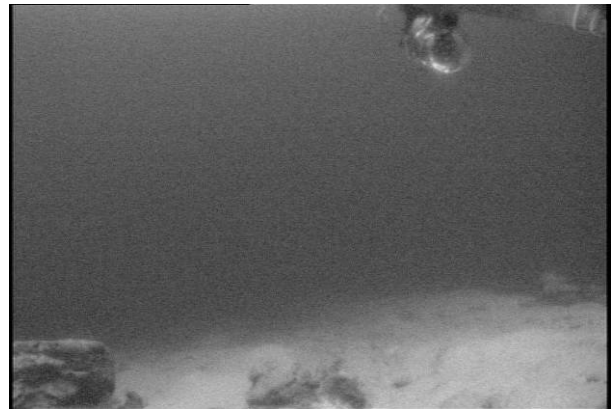
Bottom Description:

Hard bottom, dark boulders, loose substrate, some relief.

Biological Description:

Dense biological activity, including three target species.

Latitude	N 22.94054
Longitude	W 162.28726
SBE pressure (decibars)	272.24
Derived depth (m)	276
Recorded start (min)	20:31:12
Bait release (min)	n/a
Recorded stop (min)	21:31:09
Recovery time (min)	21:32:00
Estimated slope (°)	20
Min. bottom temp. (°C)	11.56
Max. bottom temp. (°C)	13.16
Avg. bottom temp. (°C)	12.29

**Nihoa (NIH)****NIH008**

10/26/06

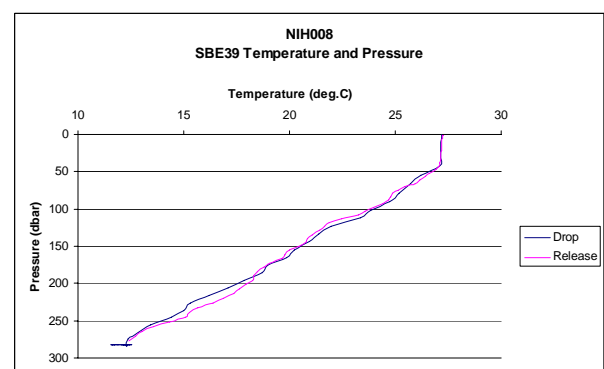
Bottom Description

Hard bottom, rocky outcroppings, loose substrate, some relief.

Biological Description:

Some biological activity, including one target species.

Latitude	N 22.93455
Longitude	W 162.27351
SBE pressure (decibars)	282.35
Derived depth (m)	295
Recorded start (min)	21:21:43
Bait release (min)	21:35:03
Recorded stop (min)	22:16:18
Recovery time (min)	2:15:00
Estimated slope (°)	40
Min. bottom temp. (°C)	11.55
Max. bottom temp. (°C)	12.57
Avg. bottom temp. (°C)	12.14



Nihoa (NIH)
NIH009
10/26/06

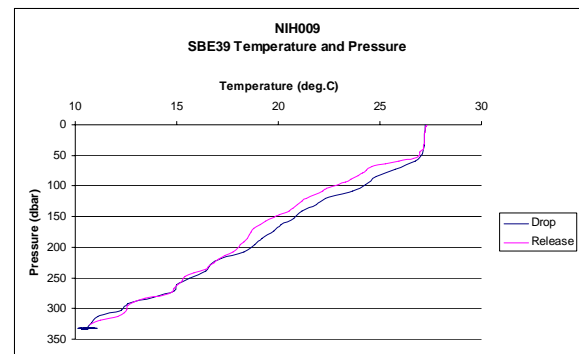
Bottom Description:

Hard bottom, rocky outcroppings, loose substrate, some relief.

Biological Description:

Little biological activity, including one target species.

Latitude	N 22.92352
Longitude	W 162.25455
SBE pressure (decibars)	331.96
Derived depth (m)	333
Recorded start (min)	23:10:17
Bait release (min)	23:23:21
Recorded stop (min)	0:04:16
Recovery time (min)	0:03:00
Estimated slope (°)	20
Min. bottom temp. (°C)	10.14
Max. bottom temp. (°C)	11.09
Avg. bottom temp. (°C)	10.68



Nihoa (NIH)
NIH010
10/26/06

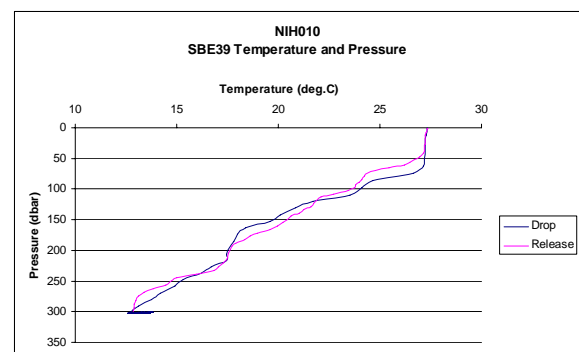
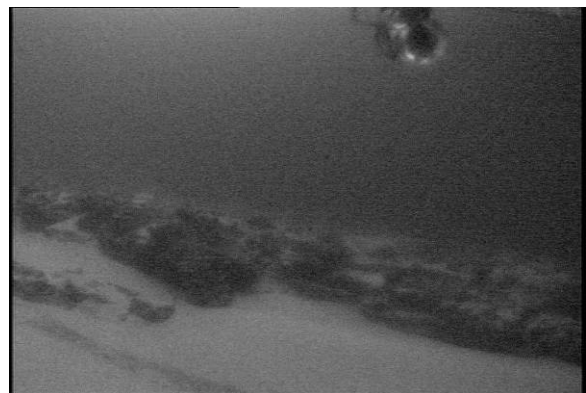
Bottom Description

Hard bottom, rocky outcroppings, loose substrate, some relief.

Biological Description:

Dense biological activity, including three target species.

Latitude	N 22.918470
Longitude	W 162.23201
SBE pressure (decibars)	301.92
Derived depth (m)	305
Recorded start (min)	1:15:13
Bait release (min)	1:29:04
Recorded stop (min)	2:04:53
Recovery time (min)	2:04:00
Estimated slope (°)	20
Min. bottom temp. (°C)	12.60
Max. bottom temp. (°C)	13.84
Avg. bottom temp. (°C)	13.12



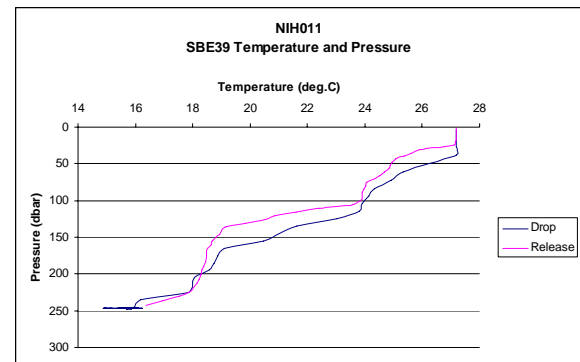
Nihoa (NIH)
NIH011
 10/27/06

Bottom Description:
 Hard bottom, rocky outcroppings, loose substrate,
 some relief.

Biological Description:
 Dense biological activity, including three target
 species.



Latitude	N 22.90384
Longitude	W 162.20662
SBE pressure (decibars)	246.52
Derived depth (m)	236
Recorded start (min)	19:10:27
Bait release (min)	19:21:27
Recorded stop (min)	20:06:07
Recovery time (min)	20:16:00
Estimated slope (°)	10
Min. bottom temp. (°C)	14.89
Max. bottom temp. (°C)	16.23
Avg. bottom temp. (°C)	15.54



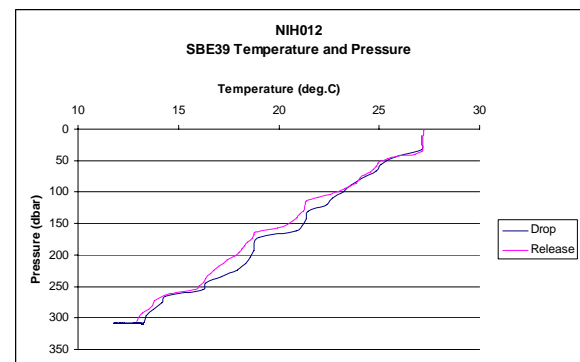
Nihoa (NIH)
NIH012
 10/27/06

Bottom Description
 Rubble bottom, low porosity, no relief.

Biological Description:
 Little biological activity, including two target
 species.



Latitude	N 22.90291
Longitude	W 162.17502
SBE pressure (decibars)	308.29
Derived depth (m)	327
Recorded start (min)	19:37:25
Bait release (min)	19:48:59
Recorded stop (min)	20:37:22
Recovery time (min)	20:56:00
Estimated slope (°)	30
Min. bottom temp. (°C)	11.78
Max. bottom temp. (°C)	13.24
Avg. bottom temp. (°C)	12.82



Nihoa (NIH)**NIH013**

10/27/06

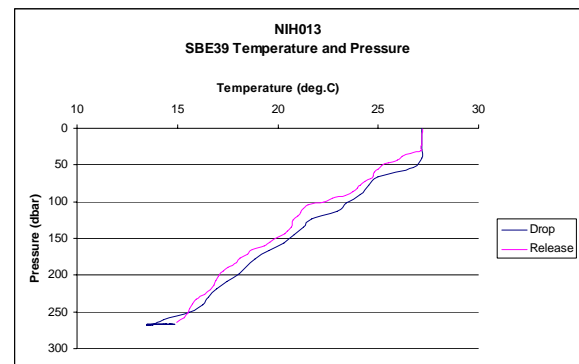
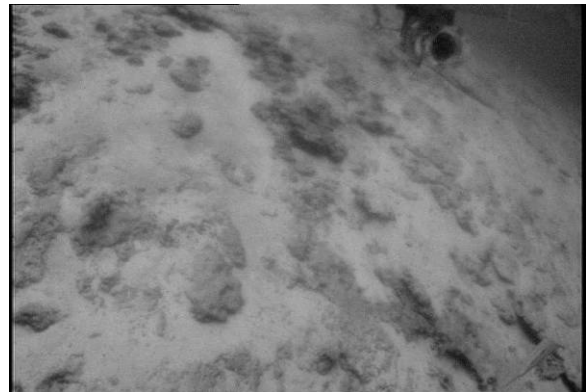
Bottom Description:

Rock/sand bottom, some porosity, some relief.

Biological Description:

Dense biological activity, including four target species.

Latitude	N 22.91080
Longitude	W 162.17242
SBE pressure (decibars)	267.16
Derived depth (m)	258
Recorded start (min)	21:00:21
Bait release (min)	21:13:22
Recorded stop (min)	21:49:31
Recovery time (min)	22:00:00
Estimated slope (°)	20
Min. bottom temp. (°C)	13.47
Max. bottom temp. (°C)	14.87
Avg. bottom temp. (°C)	13.89

**Nihoa (NIH)****NIH014**

10/27/06

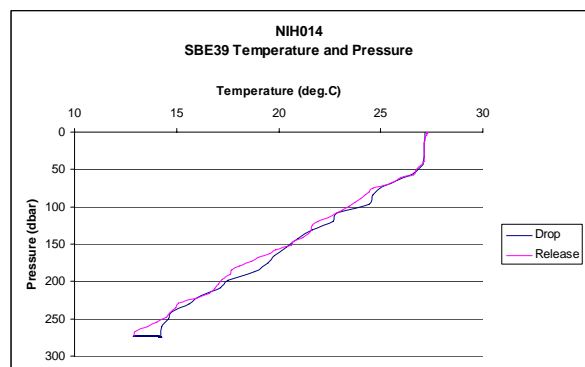
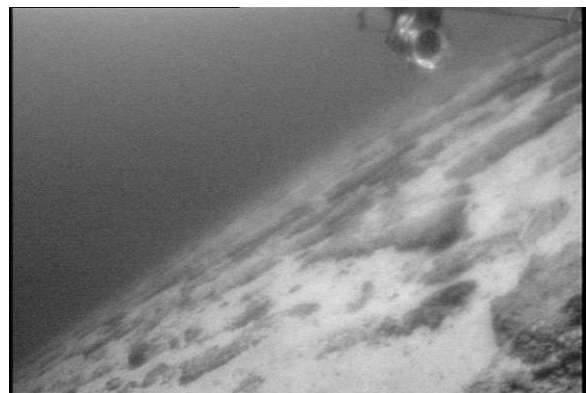
Bottom Description

Rock/sand bottom, some porosity, some relief.

Biological Description:

Dense biological activity, including four target species.

Latitude	N 22.93472
Longitude	W 162.15797
SBE pressure (decibars)	273.60
Derived depth (m)	261
Recorded start (min)	21:38:58
Bait release (min)	21:52:14
Recorded stop (min)	22:38:55
Recovery time (min)	22:53:00
Estimated slope (°)	35
Min. bottom temp. (°C)	12.89
Max. bottom temp. (°C)	14.26
Avg. bottom temp. (°C)	13.72

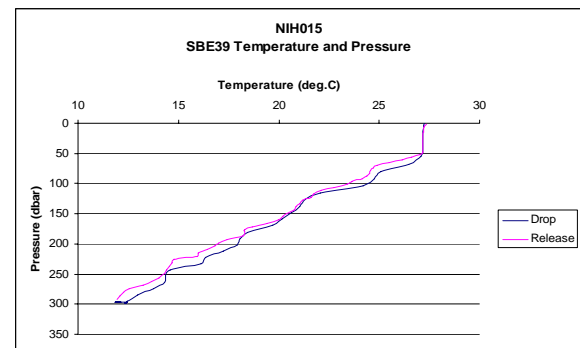


Nihoa (NIH)
NIH015
 10/27/06

Bottom Description:
 Hard bottom, low porosity, some relief.

Biological Description:
 Some biological activity, including two target species.

Latitude	N 22.95701
Longitude	W 162.13684
SBE pressure (decibars)	296.38
Derived depth (m)	290
Recorded start (min)	22:50:08
Bait release (min)	23:05:24
Recorded stop (min)	23:40:34
Recovery time (min)	-
Estimated slope (°)	40
Min. bottom temp. (°C)	11.86
Max. bottom temp. (°C)	12.44
Avg. bottom temp. (°C)	11.97



Nihoa (NIH)
NIH016
 10/27/06

Bottom Description
 Hard bottom, low porosity, little relief.

Biological Description:
 Dense biological activity, including four target species.

Latitude	N 22.97343
Longitude	W 162.12141
SBE pressure (decibars)	254.36
Derived depth (m)	255
Recorded start (min)	23:40:58
Bait release (min)	23:55:12
Recorded stop (min)	0:30:46
Recovery time (min)	0:40:00
Estimated slope (°)	20
Min. bottom temp. (°C)	14.13
Max. bottom temp. (°C)	15.23
Avg. bottom temp. (°C)	14.60

